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Marchuk Speech to Party, Economic Aktiv of Academy of Sciences

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[Speech by President of the USSR Academy of Sciences Academician G.I. Marchuk at the meeting of the party and economic aktiv of the USSR Academy of Sciences on 9 September 1987 under the rubric "The Party and Economic Aktiv of the USSR Academy of Sciences": "The Meeting of the Party and Economic Aktiv of the USSR Academy of Sciences (9 September 1987). The Opening Speech of President of the USSR Academy of Sciences Academician G.I. Marchuk"]

[Text] Today we should jointly specify the basic tasks of our work on the implementation of the decisions of the June (1987) CPSU Central Committee Plenum. Its significance, as Mikhail Sergeyevich Gorbachev noted, consists in the fact that it shifted the ideas of restructuring to the practical area, moreover, in a decpril 1985, and extends and specifies the program provisions of the 27th CPSU Congress. The connection of the June Plenum with the January Plenum, which formulated a clear conception of the democratization of Soviet society, is obvious. At the same time the June Plenum took a special place in the life of the party and the entire country.

The plenum summarized several political results of restructuring. It was stated with satisfaction that in 2 years the situation in the country had changed substantially. The process of modernization is assuming more and more specific forms, is taking in a broader and broader range of problems, and is encompassing new spheres of social life. The process of the democratization of all aspects of life is developing extensively and is intensifying in the country. An outburst of spiritual activity is being noted. In the economic sphere the attitude of people toward labor and toward the fulfillment of their production duties is changing. Many sectors of the economy have changed over to the new methods of management.

At the same time the revolutionary changes in society have brought to the forefront the contradiction between the requirements of modernization, creativity, and creative initiative, on the one hand, and conservatism, inertia, and selfish interests, on the other. One of the manifestations of this real contradiction, as was noted at the plenum, is the lack of conformity between the increasing activity of the masses and the still enduring bureaucratic style of activity in the most different fields and the attempts to freeze restructuring. The overcoming of this contradiction requires urgent and decisive steps—both in personnel policy and in the affirmation of the new approaches and norms of party, state, and public life.

The most effective means for resolving this contradiction is the extensive development of democracy. Today administrative command methods of management are slowing our movement. Democratic and only democratic forms are capable of giving it a powerful boost.

As a whole, it was stated at the plenum, despite all the complications, difficulties, and obstacles, it is possible to say that restructuring has won an ideological and moral victory. It has begun to move in breadth and in depth. But we are merely on the first wave of restructuring. A principled and frank discussion is needed, specific suggestions and constructive ideas are necessary.

And here I would like to add the following. Now we already have so many critical opinions and remarks and we see so well our shortcomings that now our main task is probably to find constructive solutions in order to aid this difficult, painful, but necessary process of restructuring.

The meeting of our aktiv is taking place 2 months after the completion of the work of the June Plenum. Everywhere plenums and meetings of the aktiv of party committees have taken place, expanded meetings of the collegiums of many ministries and departments have been held. Today we are examining our own affairs, are evaluating from the standpoint of the plenum the progress of restructuring within the USSR Academy of Sciences, and are specifying our intention in the enormous creative, constructive activity which had been launched in the country. At this meeting of the aktiv we are least of all setting for ourselves the goal to confine ourselves to explanations of the ideas of the plenum. We understand them well. It is much more important for us to focus attention on our unsolved problems and long-range questions.

I am also confident that I will be expressing the feelings and thoughts of all the participants in the meeting of the aktiv if I say that the USSR Academy of Sciences, all the republic academies of sciences, and the regional departments and affiliates not only completely approve of the decisions of the June CPSU Central Committee Plenum, but will also do everything that is within their power for the implementation of the policy of the party.

We hope that the discussion at the meeting of the aktiv will be of a truly fundamental nature and that we will be able to involve all the forces of the academy in the search for the optimum solutions and to put fully to use its intellectual and organizing potential. We are especially trying to see to it that both in form and in essence our forum would take place in the spirit of the present requirements and that its results would promote the increase of the contribution of the Academy of Sciences to the implementation of the revolutionary policy of the party.

It is difficult to reflect in an opening speech the content of the work of the June Plenum. Vice President of the USSR Academy of Sciences Academician Ye.P. Velikhov will deliver a detailed report at the meeting of the aktiv. Corresponding Member of the USSR Academy of Sciences V.A. Grigoryev, chief of the Science and Educational Institutions Department of the CPSU Central Committee, asked to speak after him. Then I will express a few remarks of a general nature. It is a question first of all of the evaluation of what has been done at the USSR Academy of Sciences since the April (1985) Central Committee Plenum, of our weaknesses and difficulties, reserves and prospects, and the means of improving the work.

It is necessary to speak about all this openly and frankly, fully satisfying the enormous interest and the demanding attention, which the party, the government, and the entire country are displaying with respect to science and the Academy of Sciences. We are all well aware that the cardinal acceleration of scientific and technical progress, the extensive introduction of equipment of new generations and fundamentally new technologies, which ensure the greatest productivity and efficiency, and the improvement of the system of management are regarded as the main lever of the intensification of the national economy. Science is called upon to make a vigorous turn toward the needs of the national economy, to make the contact with production closer, and to achieve qualitative breakthroughs in key fields and the attainment of the world level of scientific developments. In short, science needs to open up new horizons.

It is necessary to say that in the past 2 year the CPSU Central Committee and the Soviet Government have adopted a number of special decrees on the further rapid development of a number of directions of basic science: mathematics, information science, high energy physics, chemical technology, biotechnology, agrarian science, and medicine. In party decisions the major shortcomings are noted and the main tasks in the field of philosophical, socioeconomic, and legal research and in the study of cultural heritage are specified. Party and government assignments in other directions of academic science also exist.

And all the same the contribution of the USSR Academy of Sciences to scientific and technical progress is still obviously inadequate. It is well known that scientific and technical progress itself in our country has also slowed down. To a significant extent such a situation formed due to inertia and the poor receptivity of our national economy to innovations. But we will not write everything off to imperfections and direct omissions in the mechanism of introduction. Science as a whole and our academy in particular bear here their own share of the responsibility.

Meanwhile—and this should be specially emphasized—precisely academic science is called upon to ensure by its basic research breakthroughs in the most important sections of the development of social production.

Under the conditions of restructuring the social role of science is also increasing drastically, the social and moral duty of scientists is growing. The development of science today worries the broadest strata of the population. And this is natural. Never yet have scientific projects and decisions affected so directly the fates of millions and millions of people, entire countries, and the entire planet. The problems of the development of space, the development of nuclear power, and genetics are only a small portion of what worries today the broadest strata of the public. Let us recall what public repercussions the problems of industrial construction at Lake Baykal and other ecological problems caused quite recently. It is especially necessary to speak about such global problems as the securing of peace on earth, the elimination of the threat of a nuclear catastrophe, and environmental protection—these are problems that are common to all mankind. The tragedy at Chernobyl and other, although not as major, mishaps, which were connected with the operation of complex systems, were painful lessons.

In other words, the social role and, let us stress, the social responsibility of science today have increased fundamentally and, hence, our demandingness on our work, no matter at what level and on what scale it is performed, should increase even more. I will say once again that for all the gains, which have been made by Soviet scientists, our science itself and the USSR Academy of Sciences need restructuring. We have a vital need for strict and objective self-analysis, which is capable of indicating our own mistakes and omissions and, what is the main thing, of ensuring a breakthrough in the most important directions of scientific research. We must determine ourselves the truly most important basic directions of the development of scientific research, truly effective organizational forms, in which science operates, a "working" mechanism of the management of science, and the real needs of its material and financial supply and social development.

As for the USSR Academy of Sciences, we have already taken the first steps in restructuring. Following the General Assembly of the academy, which was held in October 1986, steps were taken on the restructuring of management in the system of the Academy of Sciences. Among them I will name first of all the decisions aimed at increasing the role of the departments of the USSR Academy of Sciences, which should be the basic scientific and scientific organizational centers which are responsible for the development of basic research in the corresponding fields of science in the country.

Many rights, which are enabling them to govern the evolution of scientific developments at their scientific institutions and to coordinate basic research on the scale of the entire country, have been delegated to the departments. It must be said that the process of broadening the rights and increasing the responsibility of the departments has not yet been completed. To a significant degree it is also a matter of the departments themselves, which are assimilating far from uniformly

the new spheres of their activity. And here a more resolute shift from the problems of the coordination of science to the problems of the genuine management of science is needed.

Within the framework of the restructuring of the Academy of Sciences a number of measures were implemented in the area of regional scientific policy: the Far Eastern and Ural scientific centers were transformed into regional departments of the USSR Academy of Sciences. Moreover, the procedure of election to the USSR Academy of Sciences was improved and a number of urgent questions of personnel policy at the academy were settled.

However, all this reflects only the first, initial phase of the organizational restructuring of the management of academic science. We should also develop and intensify the process of restructuring in the future, so that it would encompass all aspects of the activity of the USSR Academy of Sciences. It is necessary to deal constantly and thoroughly with the improvement of the management of science in the system of the academy.

In conformity with the tasks, which were posed by the June CPSU Central Committee Plenum, the research on the radical restructuring of the management of the economy, on the economic mechanism, and on the problems of social development should be increased drastically. The decrees on the restructuring of the management of the economy, which have been adopted by the CPSU Central Committee and the USSR Council of Ministers and concern ministries, departments, and local organs, contain specific assignments for the USSR Academy of Sciences, which are aimed at the stimulation of the activity of scientists. First of all these assignments pertain to economists, philosophers, lawyers, and sociologists. But if we take into account that entirely new conditions are now arising in all industry, when the economic mechanism will orient all the sectors of the national economy and enterprises toward the obtaining and distribution of internal capital through the profit, it becomes obvious that many scientific and technological results, especially the ones already ready for introduction, will find their embodiment in the sectors of the national economy. The entire academy, which, if it is possible to say it this way, has yearned for effective contacts, should prepare for this.

Now the task of the participation of scientists of the USSR Academy of Sciences in the elaboration of the prepared reforms of the system of pricing, the financial and credit system, and material and technical supply and in the radical restructuring of planning is especially urgent. The foundation of the solution of these problems was laid by the most important Law on the State Enterprise (Association), which affirms the main principles of management—full cost accounting, self-financing, and self-support [samookupayemost].

V.I. Lenin said that science needs not dogmas, but facts. Many enterprises are already operating under the conditions of self-support [samookupayemost] and self-financing, and the thorough analysis of their activity and the scientific interpretation of the facts of life from a Marxist-Leninist standpoint are required of economic scholars. Scientific analyses should be oriented in such a way that we would enter the 13th Five-Year Plan with a developed economic mechanism.

The task posed by the plenum—to enter with 13th Five-Year Plan with a new economic mechanism—requires the proper legal support of the measures on the formation of such a mechanism. In this connection the implementation of the decisions of the plenum on the development and improvement of economic legislation is being placed in the forefront.

The problems of the democratization of the entire system of state management should constitute the most important direction in legal and sociological research. The basic provisions, which are contained with regard to this question in the Law on the Enterprise, require thorough theoretical elaboration from a legal and social standpoint.

Under present conditions the question of the importance of the economic contract in the organization of economic relations should be posed in a new way.

The radical changes in planning presume the substantial increase of the role of the economic contract as the basis of the formulation of the plans of the production and sale of products. The problems, which are connected with the development of wholesale trade in means of production and with the gradual rejection of the central allocation of material resources, which has become a hindrance to the development of our society, need to be studied. Direct ties and the possibility of the quick reaction of suppliers and consumers on the basis of a mutual understanding—this is the form, to which we are now changing over and which during the next five-year plan will completely change the situation in supply in our country, having made it efficient and mobile. The economic contract is now becoming a tool of the implementation of the principle of economic competition among enterprises and the assurance of the priority of the consumer in economic relations.

All these problems were raised at the plenum. They need thorough theoretical analysis and the search for new constructs, in which these fundamental features would be implemented and specified by scientifically sound provisions, which would open for society the way to broad, efficient self-development.

Many new problems are being posed for philosophers and sociologists and for specialists in the field of history, literature, and art. These are first of all the problems of

the further development of democracy and the formation of the Soviet individual and the socialist way of life under the conditions of the radical changes of our society.

It is necessary to speak particularly about the assistance of academic institutions to Moscow organizations in the solution of the problems of scientific and technical progress and socioeconomic development. Nearly two-thirds of the potential of our academy is in Moscow. It is intended in the immediate future to discuss the program of research on these questions at a joint meeting of the Presidium of the USSR Academy of Sciences and the Executive Committee of the Moscow City Soviet.

The guarantee of the success of restructuring at the Academy of Sciences is connected with the questions of the democratization of the management of science and all scientific life, which are being discussed in such a lively, pointed, and interested manner at all levels, from the Presidium of the USSR Academy of Sciences to the local units of scientific institutions. I would like to note the following with respect to this question.

Along with the general criteria, which are characteristic of the process of democratization in all of society—their decisive importance is not subject to doubt—in every sphere, including science, its own requirements operate. Here it is necessary to develop the creative competition of different ideas, scientific programs, and research schools. In the struggle of scientific approaches the one, whose plans and suggestions are more fruitful and promising, should win. Democracy in science is called upon to ensure talented young people an opportunity for the display of talents, the extensive discussion and comparison of the obtained results, and the strengthening of the connection of science with the development of all of society.

If we look at our institutes, at many of them the same themes continue for 5, 10, 15 years. Although they do change somewhat and are adjusted cosmetically, in many cases we do not observe radical changes that are connected with the development of all science. This is what worries us most of all. Therefore, our main attention should now be drawn to the stimulation of intra-institute life. And here the members of the academy should voice their decisive opinion.

In noting and reflecting the main trends of development of science in our fields, on the basis of the forecasting reports, which were drawn up by the Academy of Sciences and in the immediate future will be considered and approved by the departments and the presidium, we should aim all the organizational and scientific problems in the direction of long-range, active, and dynamic progress. This is the only means for the overcoming of inertia and the attainment of great gains and effective methods of scientific work.

Democratic traditions have existed for a long time at the USSR Academy of Sciences. It is well known that V.I. Lenin rated highly the role of the Academy of Sciences in the life of the country. The norms and traditions of intra-academic democracy have constantly changed and been improved. They contributed to a large extent to the achievement by our science of outstanding results in many scientific directions, as well as ensured the depth and freedom of scientific opinions and the struggle of various scientific concepts, without which the real development of science would be impossible.

Of course, the system of democratic norms and regulations, which has formed at the Academy of Sciences, should be developed and improved further. We should not repeat the mistakes, which have been made here and in our country as a whole in the evaluation of individual scientific directions. Now our responsibility is being increased substantially, because at the June Plenum it was stated that now the Academy of Sciences settles independently the question of the means of development of basic research, it has been given this right. This imposes an obligation on us, and, therefore, our task is to create on the basis of the extension of democracy the conditions for the development of all the most important trends, on which our science and society will live.

Thus far the restructuring at the academy has affected mainly the top levels of the organizational management structure, while the certification of scientists at the institutes of the USSR Academy of Sciences, which was carried out in 1986, although useful, was carried out in many cases formally and did not solve the problem of stagnation in personnel policy. The Presidium of the USSR Academy of Sciences for the most part approved of the suggestions, which have as a goal to realize on the basis of democratization the next phase of restructuring—at the level of the academic institute and its structural subdivisions. A special commission has been charged to develop these suggestions, after which they will be turned over for extensive discussion to the collectives of scientific research institutes, and then will be submitted to the Presidium of the USSR Academy of Sciences for approval.

Many questions are leading to the need for the specification of the Charter of the Institute and the Charter of the Academy of Sciences. It is a matter first of all of the election of the director of an institute to a new term. The members of the Presidium of the USSR Academy of Sciences believe that the main say in the settlement of the question of the appointment of a director, that is, the scientific leader of an institute, should belong to the most qualified specialists in the corresponding field of science. Therefore, in conformity with the decisions of the March session of the General Assembly of the USSR Academy of Sciences it is proposed (in those instances, when the 5-year term of office of a director has expired or which the position of director has become vacant) to elect the director of an institute by secret ballot at the General Assembly of the department of the Academy of

Sciences. Here it is intended to afford the possibility of the nomination (including by the collective of the given institute) of several candidates for the position of director. I will note that each candidate is obliged to submit a scientific report on the proposed program (concept) of the work of the institute. The report will become the topic of the most careful discussion in the department.

In personnel policy the academy is giving particular support to its basic scientific unit—doctors of sciences. It is proposed to expand their participation in the management of science. It is obvious that it is possible to do this by the change of the procedure of the formation of scientific councils and the increase of their role in the scientific life of institutes. It is proposed not to appoint, but to elect the members of the scientific council to a new term at a general meeting of all the scientific associates of the institute by secret ballot. This will be the next phase of democratization.

It is also planned to carried out in a new way the appointment and election of the managers of the structural scientific subdivisions (departments, sectors, laboratories), which are envisaged by the new structure of the institute. The essence of the proposed restructuring in the management of scientific subdivisions lies in the following.

In those subdivisions, which previously existed and have been retained in the new structure of the institute, it is proposed at the meetings of the labor collectives to elect the candidate managers by secret ballot. These candidates should then be considered by the scientific council of the institute on the basis of the open competition of the concepts and plans, which are suggested by them. After hearing the reports of the candidates the scientific council could make by secret ballot a final decision on the election of one manager or another of the structural subdivision to the position.

If it turns out that none of the candidates satisfies the corresponding requirements, then, after three votes (this is usually used in work here), the scientific council at its discretion elects the leader, whose candidacy it considered appropriate.

For newly established structural subdivisions it is proposed to conduct in the scientific council an open competition of scientific plans. In the materials of the plenum it was recorded that it is necessary to agree to competitions of plans and to develop competitiveness. This idea should literally become a part of the structure of our academic subdivisions. On the basis of the discussion of the plans the scientific council could elect by secret ballot the managers of the subdivisions. Such a procedure will make it possible to elect truly creatively working scientists. It is proposed here to ensure the possibility of the voluntary transfer of staff members to the new structural subdivisions. This feature is especially importance, because here we have inertia and dogmatism, several traditions, which are unacceptable under the conditions of the rapid, dynamic development of science, have formed.

It should be noted that members of the Academy of Sciences will not be elected by competition, inasmuch as their election to the Academy of Sciences is already recognition and quite sufficient grounds for the director to appoint them to the positions of managers of subdivisions, as is envisaged by the existing statute.

Without listing all the planned structural innovations, I will note just the problems of the establishment of special-purpose temporary scientific research collectives. They are necessary for the concentration of forces in new promising scientific directions for a specific period. This is the most important tool for the identification of talented scientists and the implementation of promising ideas. We should develop this form of the organization of scientific activity. It is necessary that scientific schools would operate and be developed in the formed subdivisions. If new schools appear, it is also necessary to establish permanent structural subdivisions. Extensive research should include the interinstitute cooperation of many subdivisions in special-purpose directions of science. It is necessary to transfer staff units more boldly to such collectives for the settlement of important questions: if the collective then achieves success, it can become a new structural subdivision with the goals that the scientific council has approved. If the research proves to be unjustified, the staff members should return to their own subdivisions and continue work there.

It is necessary to show consideration for the establishment of temporary subdivisions and to support this cause. The presidium has returned to this question several times. And we believe that in the future a fourth or a third of our organizational possibilities should be channeled into these temporary special-purpose collectives.

Now nearly the entire scientific world is working in accordance with the goal principle. We should not introduce it everywhere, because scientific schools, for which stability is needed, are being established at the academy. But searching and risk taking in the implementation of scientific ideas are advantages of the temporary collective, in which the labor and knowledge of people of different specialties are integrated and in which new results can be achieved sooner and important directions can be developed.

For the future of the Academy of Sciences and all Soviet science it is very important to ensure the influx of talented young people to institutes. The Presidium of the USSR Academy of Sciences has adopted in this regard a number of decisions, which involve the updating of the composition of scientific associates and the creation of the conditions for the attraction of graduates of higher educational institutions.

The decrees, which were adopted in March 1987 with respect to the development of science at the higher school, are exceptionally important for us. In this series of decrees substantial space is allotted to the contact of the Academy of Sciences with higher educational institutions. In May 1987 we held a joint meeting of the Presidium of the USSR Academy of Sciences and the Collegium of the USSR Ministry of Higher and Secondary Specialized Education. A set of important problems both with respect to the training of personnel and with respect to the integration of academic and VUZ science was outlined. Indeed, many higher educational institutions have outstanding results, and it is necessary to involve them more closely in the overall system of the management of basic science.

The settlement of many questions is coming up against the weakness of the social sphere and the sluggishness of the central staff of the academy. We need to maintain a firm line here, for all of us together bear responsibility for the future of science.

The organizational and personnel questions, with which it was necessary to deal a lot at the Academy of Sciences in recent times, cannot, of course, push into the background the primary and most important thing—the development of basic research, about which I spoke at the beginning of my speech. We have now specified the programs, which are of academywide importance, and a significant number of programs in the priority directions of the departments. These are also our state assignments for ourselves, for the republic academies, for higher educational institutions, and for leading sectorial institutes. This system will determine for us the plan of work and will make it possible to clearly follow and manage the organizational forms which ensure the development of what we ourselves create.

It is necessary precisely now to focus attention on the scientific aspect of the matter and to ensure a bold creative search. It is necessary to "tune" to the system of scientific work both the system of problem scientific councils and the system of financing, material supply, and so forth.

As is known, a fundamental decision in the area of the financing of science in the country was made at the June Plenum: not institutes, but specific scientific problems should be financed. Of course, the Academy of Sciences and higher educational institutions have their own specific nature, this will be spoke about. But all the same this restructuring should also affect us, so that the programs, which we are now developing, are also first of all a passport for the obtaining of financial assets from the state. Of course, other sources, which would supply our extensive research and unpredictable needs, are also required; all this will be provided by a unified system of financing.

The increase of the role of the Academy of Sciences as the center of basic research is a natural trait of the present stage of the development of Soviet science. A specific feature of our work also consists in the fact that we should increase the assistance to the national economy through such research. In the end the success of applied developments and the development of sectorial science depend precisely on us. Therefore, it is natural that a budget procedure of financing is in effect for the Academy of Sciences; at the same time the role of the problem-oriented financing through state orders on basic and applied research of the long-range plan and the academic programs, which are being formulated by us, will increase.

The new economic mechanism is affording opportunities to improve the practical implementation of the achievements of science. It is necessary to create the economic conditions so that the collective of any institute and each individual staff member would be interested in seeking means of introducing their developments and in case of success could count not only on a moral incentive, but also on the corresponding, perhaps even large, material reward. Our economists, who jointly with economic departments should formulate new principles of the stimulation of our scientific associates for the achievement of high results, should perform such work.

It is necessary to use significantly more extensively the possibilities of international scientific cooperation and the development of bilateral and multilateral projects and individual specimens of instruments and equipment jointly with scientists of the fraternal socialist countries. Here we have great opportunities, now changes also exist, but it is necessary to work actively on this.

One must also not forget the fact that by a decision of the government the USSR Academy of Sciences was granted the right to appear on the foreign market. We have developments which it is possible to offer foreign partners, especially in the area of scientific instruments. If we quickly accomplish the implementation of those instruments which originate at our institutes, it will be possible to attain the world level of instrument making and, through the new instruments, new levels of development of basic, first of all experimental, research.

Now the corresponding rights are being given to us. Let us cooperate with the socialist countries. If there is mutual advantage, let us also work with scientists of capitalist countries, let us sweep away the existing notions of science which can be developed only locally. It should be developed as a whole and take in everything new that has now been accumulated by mankind. And it is necessary to see that first of all our interests would be guaranteed.

The new form—MNTK's (interbranch scientific technical complexes), which are becoming the leaders in the development of the most revolutionary ideas of new

equipment and technology, is affording great opportunities for the development of science. They should in principle implement the entire chain—from basic ideas to large-scale production at enterprises. But we have not yet found a mechanism that would ensure the functioning of such a chain. We should actively deal with this, and I believe that in the immediate future significant suggestions on this question will be considered.

Now, when the restructuring of the entire system of management is being developed, first of all in the sphere of the national economy, it is useful to look in a new way at the role and place of the Academy of Sciences. The academy is acquiring new opportunities to settle the entire set of questions which are connected with the development and coordination of basic research in the leading directions of science. However, it is extremely important that our institutions and centers would conform to their new role and would be genuine leaders and real headquarters of Soviet science. Only on such a basis can an enduring unity—the statewide system of scientific research, including academic, VUZ, and sectorial science—also be formed.

During the present period the careful analysis of the Comprehensive Program of USSR Scientific and Technical Progress for the Period to 2010 is of fundamental importance. It is necessary that it would become the basic preplanning document and the basis for long-term planning in conformity with the economic strategy of party.

It is useful to dwell if only briefly on the general questions of the development of the USSR Academy of Sciences and the academies of sciences of the union republics. The time has come when it is necessary to urgently discuss many of them. In beginning the most important changes, which are characteristic of the new stage of development, our country not only is placing science in the forefront, but is also working on the problems of its support and the creation of the scientific base and the corresponding working and living conditions of scientists. But many problems have accumulated here. At many institutes the discontent of scientists with the conditions, under which they work, not only remains, but is also becoming more acute. Facilities became crowded long ago, there are not enough of the latest equipment, preparations, and so on. The situation with pilot and production bases is poor. In short, the lag of the Academy of Sciences is hindering the progress of research.

The remainder principle of the approach to the solution of social problems, which did considerable harm on the scale of the entire country, to a significant degree also affected the Academy of Sciences. Housing construction is being carried out at an inadequate pace, scientific associates are validly complaining about the state of medical service, the resort and sanatorium system, and children's institutions. Previously these and other questions remained outside the field of view, but now the Presidium of the USSR Academy of Sciences is dealing with them very actively.

A plan of the development of the Academy of Sciences to 2000 is being prepared. We are trying to see to it that the preparation of this document would proceed in a democratic manner. More than 150 letters from members of the academy on the improvement of the activity of the USSR Academy of Sciences have been received by the Presidium of the USSR Academy of Sciences. I want to express gratitude to all these comrades, who gave us the opportunity to consider the questions which were overlooked in the initial plan of the presidium. The suggestions were carefully studied and were used during the work on the plan. There are a number of remarks on the plan, which were received from the academies of sciences of the union republics. The main thing in the document is the radical improvement of construction and the material base, the restructuring of the system of financing of research, and the solution of urgent social problems. Particular attention is devoted to the development of science in Siberia, the Urals, and the Far East.

A large scientific potential has formed at the republic academies of sciences. Scientists of the union republics are working in many directions at a high level. The academies of sciences of the Ukraine, Belorussia, and several other union republics have great international prestige. However, not all the republic academies have such prestige. A particular misfortune, in our opinion, consists in the fact that several of them are attempting to imitate the USSR Academy of Sciences both in their structure and in the range of scientific research. It is necessary to see to it that every republic academy would be the leader of specific scientific directions in the system of the organization of all science in the country. It is necessary to strengthen as much as possible at them those directions of research, which will yield the greatest impact precisely in the given republic. And all of them should be subordinate to the goals, which we are now setting our ourselves in the forecasting reports and in the all-union programs of scientific research, which are being formulated on their basis, will be the heart of the development of all basic science in the country, and will also connect basic science in all departments and at all sectorial academies into a unified whole.

I recently visited a large number of academies of sciences of the union republics: the Ukrainian, Belorussian, Azerbaijan, Georgian, and Armenian academies, and saw the major changes that have begun there under the conditions of restructuring. Many problems have been correctly stated. Several have already been solved. But we still have much work ahead. Therefore, the role of the Council for the Coordination of the Activity of the Academies of Sciences should be increased immeasurably so that all the scientific and organizational activity

of the USSR Academy of Sciences would be thoroughly and most carefully discussed and coordinated with the work of the republic academies.

Here it is necessary to note the importance of the improvement of relations, within the framework of the Council for Coordination, with higher educational institutions of the country, with the All-Union Academy of Agricultural Sciences imeni V.I. Lenin (with which we have longstanding, traditional contacts), and with the Academy of Medical Sciences. Academician Yu.A. Ovchinnikov in recent times has performed much work on the development of relations with medical science and with the All-Union Academy of Agricultural Sciences imeni V.I. Lenin. This work must be developed further.

Some improvement of the work of the Higher Certification Commission is occurring. Now a new chairman of the Higher Certification Commission, Academician Ye.I. Shemyakin, has been appointed. Recently the Presidium of the USSR Academy of Sciences jointly with V.G. Kirillov-Ugryumov, former chairman of the Higher Certification Commission, held an important meeting, at which the basis for the further improvement of coordination with the Higher Certification Commission, with which we will also cooperate in the future, was developed.

The realities of our times and the problems of the prevention of nuclear war and the preservation of peace on earth require of Soviet scientists the stepping up of efforts in the struggle for peace. The Committee of Soviet Scientists for the Defense of Peace and Against the Nuclear Threat and the Scientific Council for the Study of Problems of Peace and Disarmament are actively working here. Scientists of institutes of the international type and a number of other institutions are performing much work.

The large actions, which we conducted, evoked an enormous response of the world scientific community, showing in deed our democratism, candor, glasnost, and resolve in the struggle for peace on the planet.

In the missile and space age every scientist and every worker of science should raise his voice in defense of mankind against the threat of nuclear obliteration. No one better than scientists can foresee the consequences of nuclear conflict, which is capable of obliterating life on earth. The duty of Soviet scientists is to do everything that depends on them for the explanation of the destructiveness of nuclear war and for the struggle for the creation of a nonnuclear and nonviolent world.

In conclusion let me express confidence that the meeting of our aktiv, which is being held during the year of the 70th anniversary of the Great October Socialist Revolution, will become an important milestone in the life of the USSR Academy of Sciences and in its work on the advancement of Soviet science to the most advanced levels.

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UDC 001

Grigoryev Speech to Party, Economic Aktiv of Academy of Sciences

18140146c Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 12, Dec 87 pp 27-33

[Speech by Corresponding Member of the USSR Academy of Sciences V.A. Grigoryev, chief of the Science and Educational Institutions Department of the CPSU Central Committee, at the meeting of the party and economic aktiv of the USSR Academy of Sciences on 9 September 1987 under the rubric "The Party and Economic Aktiv of the USSR Academy of Sciences": "The Speech of Corresponding Member of the USSR Academy of Sciences V.A. Grigoryev, Chief of the Science and Educational Institutions Department of the CPSU Central Committee"]

[Text] From April 1985 to June 1987 the party and the country covered a difficult, but most creatively saturated path. Characteristic of it first of all is the fact that the ideological and theoretical platform of the acceleration of the socioeconomic development of the country was mainly and primarily created and the political program of restructuring and the achievement on this basis of a qualitatively new state of Soviet society was formulated.

The conception of acceleration is the theoretical and practical expression of the objective demands of the present stage of the development of socialism. Such a conception, as we know, did not form all at once. Step by step, on the basis of the historical materialistic analysis of the accumulated contradictions and problems the party Central Committee specified the tasks and advanced new approaches and ideas. And what is important, the theoretical conclusions acquired from plenum to plenum the content of a more and more precise and complete program of the modernization of all aspects of the life of our society.

Man as the goal of social progress and the human factor as its decisive and creative force are being placed more and more consistently at the center of all party policy.

The formulation of the strategy and tactics of the transformation of our society required a turn to scientific thinking and to the search for new theoretical solutions of the building of socialism. One of the peculiarities of the post-April period is the fact that all the major decisions of the party are based on the achievements of scientific thought. The attention to science and to the conclusions and suggestions of scientists has increased appreciably.

The decisions of the 27th CPSU Congress and the Central Committee plenums are an example of the creative application of scientific methodology to the analysis of the present state of our society and the

prompt conversion of the advanced ideas into a factor of social progress. Under such conditions the role of science is increasing substantially. The party Central Committee by its bold innovative approach is setting the tone in the development of the Marxist-Leninist theory of socialism. On the basis of precisely such an approach to the evaluation of social development the deep-seated causes of stagnation were identified and means of getting out of this situation were outlined, the barriers for giving a boost to all the motive forces of scientific, technical, social, and spiritual progress were overcome.

In the process of developing the conception our notions about the laws of the development of socialism and about the dialectics of productive forces and production relations were significantly enriched.

The questions of the realization of scientific and technical progress, the increase of the role of the human factor, and the formation of new political thinking were posed in a new way.

At the January (1987) CPSU Central Committee Plenum Lenin's theory of socialist democracy, the self-government of the people, and party personnel policy underwent development. As a result democracy, glasnost, appointment by election, and the language of the truth began to flow as a mighty current into social consciousness and into the daily life of the Soviet people.

The June (1987) Plenum of the party Central Committee ensured a genuine revolutionary breakthrough to new economic thinking. The radical reform of the management of the economy is also the reform of our scientific notions about the base and superstructure of socialism. Understanding the full extent of responsibility to the people, the party is showing today an example of scientific courage and profound political self-consciousness. At the June Plenum it was frankly stated that an alarming trend is occurring—the lag of a number of party organizations behind the dynamic processes which are developing today in society.

The Central Committee has been constantly indicating the need for the application of scientific methodology to the analysis of the process of restructuring.

The restructuring in the economy and in all the units of the economic mechanism has been occurring not without difficulties and, as we know, not without contradictions. It constantly needs a serious scientific forecast, a comprehensive, systems, integral forecast.

The scientific support of restructuring today is being placed for us in the forefront. The task is to enrich, as was emphasized at the June Plenum, the notion of socialism with allowance made for historical experience and objective conditions.

Today the question, by what criteria is one to measure development in the future and by what most effective means one is to achieve a new quality of the social system, is urgent. It should be particularly stressed that in the elaboration of the most difficult, but main problem in the theory and practice of socialism, which was posed by the June Central Committee Plenum—how on a socialist basis to develop a more powerful system of economic, scientific, technical, and social progress than under capitalism and how to combine most effectively planned management with the interests of the individual and the collective—an enormous role belongs to our Academy of Sciences.

It is appropriate to recall the thesis of the need for the deep mutual penetration of the natural, technical, and social sciences as an objective requirement of the present stage of social development.

The integration approaches to the accomplishment of the difficult tasks of the present should be regarded as one of the basic directions of the new science policy of the Academy of Sciences and its institutes.

The interrelations of industry and agriculture, production and the social infrastructure, scientific and technical and social progress, science, education, and culture have become so deep that any lag of any of these spheres immediately affects the others and upsets the rhythm of all social life. And such precisely comprehensive integration approaches are accessible only to the Academy of Sciences, which has a theoretical arsenal of knowledge in all fields of science.

The Academy of Sciences, which has an abundant intellectual potential, is capable of giving a significant response to the decisions of the June CPSU Central Committee Plenum and of completely fulfilling the social order, which has been received by it from society, on the basis of the objective need of its development.

Under the new conditions of management the role and place of the academy in the multilevel economic mechanism are changing radically. Today the front line of the struggle for the acceleration of scientific and technical progress in the national economy runs, as M.S. Gorbachev stressed, through science. The achievements of the scientific and technical revolution should ensure a breakthrough to a new quality of the productive forces of society.

The favorable economic prerequisites, which were created by the June CPSU Central Committee Plenum, should be completely realized already during the 12th Five-Year Plan. The new principles of the economic interaction of academic science with the sectors of the national economy have to be assimilated.

The prognostic function in science is acquiring enormous importance under present conditions. The task of the radical change in the formulation of the approach to the Comprehensive Program of Scientific and Technical Progress for 20 Years and the significant increase of the scientific soundness of all its directions and sections is well known to you. Academician G.I. Marchuk has already spoken about this in detail.

The Academy of Sciences is called upon to plan a decisive role in the choice and substantiation of the priority fields of scientific knowledge and in the forecasting of science as a whole.

The quality of the scientific expert evaluations of the most important achievements of domestic and world science and major national economic projects has to be increased substantially. The long-range forecast and the timely identification of potential technological breakthroughs are capable, as practical experience shows, not only of having a revolutionizing effect on the development of productive forces and all social production, but also of providing powerful stimuli of the development of basic science itself.

In recent years important decrees of the CPSU Central Committee and the USSR Council of Ministers on the development of research in the field of mathematics and its applications, high-energy physics, chemistry and chemical technology, and biochemistry and on the development and production of instruments and means of automation of scientific research have been prepared and adopted on the initiative and with the most direct participation of the USSR Academy of Sciences. The steps outlined by these documents are an example of the new comprehensive approach to the development of these fields of knowledge. The interests of science are now fundamentally linked with the development of industry and even with the formation of its fundamentally new directions. The CPSU Central Committee supports such approaches.

The reform of the management of the economy is posing today for scientists as one of the most important ones the problem of the systems analysis of the state of affairs in all sectors of the national economy. We have, for example, a program of the modernization of domestic machine building, immense work with the aim of achieving important end results has been launched. However, as was noted at the plenum, the posed tasks are being accomplished slowly, here it is still a long way to the turning point. The inadequate methodological and economic systems analysis of the program itself is apparently one of the causes of this.

Machine building is one of the leading units of the national economic complex, which closely interacts with all sectors and, in reality, determines their efficiency. Therefore, it is impossible to achieve the drastic improvement of its work in isolation from the level of development of its partners and the corresponding personnel and scientific support. The indepth scientific analysis of these questions, which can be made only in the close cooperation of production workers with economists, sociologists, mechanics scholars, physicists, and mathematicians, is needed. Such an analysis would make it possible also to formulate clearly the social order to the Academy of Sciences for some promising directions or others of scientific research in this and other fields.

The gradual changeover of scientific institutions to full cost accounting and self-financing is envisaged by the decisions of the June Plenum. The cost accounting component probably should be strengthened at the Academy of Sciences as well. But this matter is extremely difficult. The aspiration to turn the scientific product into a commodity should not overshadow the main function of the academy—the obtaining of basic knowledge.

The cost accounting basis of the interaction of the Academy of Sciences with sectors of the national economy, apparently, can be welcomed when the applied development being performed follows directly from basic research as its logical continuation.

It is natural in this case to raise the question of a certain sharing of the client as well in the financing of basic research itself. In other words, not only the tangible developments of scientific research institutions in the form of specific instruments, machines, and technologies, but also new ideas and principles, apparently, should become the commodity production, which in a number of cases will also be the most valuable commodity. All this leads to the need to revise radically the legal and financial aspects of the interaction of academic, VUZ, and sectorial science and of their economic relations with production. It seems that today this is one of the most important questions and the contribution of scientists—economists, lawyers, philosophers, and sociologists—to its settlement should be decisive.

The coordination of the activity of scientists of the Academy of Sciences and higher educational institutions holds a special place in the integration of science. This has also been spoken about here. The steps on the improvement of higher education in the country, which were planned by the party Central Committee and the USSR Council of Ministers, provided the necessary conditions for the development of this work. Scientists of the Academy of Sciences have been afforded today opportunities for the broadest participation in the training of young specialists, in the formation of scientific schools, and in the establishment of joint educational scientific centers and laboratories and temporary creative collectives.

Prerequisites have been created for the broadening of the contact of scientists of the academy and higher educational institutions. The departments of the USSR Academy of Sciences with their scientific councils and the problem councils for fields of knowledge of the USSR Ministry of Higher and Secondary Specialized Education should make a large contribution to this work.

The idea of the joint development of the infrastructure of academic and VUZ science seems very promising.

It is well known that precisely the lack of the necessary pilot experimental base, which is capable of bringing the developments of scientists up to the required technological level, is one of the main difficulties of the introduction of the results of both academic and VUZ science in the national economy. On the other hand, the acute shortage of science-intensive production capacities, which are oriented toward the output of unique small-series equipment and instruments, is being felt in the country.

Both these problems could be solved by the establishment of joint specialized production bases in the priority directions of science and technology, which operate on the principles of self-support [samookupayemost], self-financing, and cost accounting.

The establishment of joint scientific production enterprises with foreign firms, first of all within the Comprehensive Program of Scientific and Technical Progress of the CEMA Member Countries, which have significant production capacities and relations with which the USSR Academy of Sciences and the USSR Ministry of Higher and Secondary Specialized Education are now intensively developing, could be another effective mechanism in case of the assimilation of scientific developments. Precisely such initiatives and nontraditional approaches are being used by many members of our academy, when it is a question of the fulfillment of the decisions of the June CPSU Central Committee Plenum. Work has already been launched in this direction. It is now important that these processes would be developed vigorously and that an irreversible nature would be lent to them. It is important not to stop at the search for new forms of interaction and to reject resolutely obsolete, exhausted approaches.

The scale of the tasks facing the academy obviously requires the further improvement of the structure and quality of the management of academic science. In this connection reassuring changes have occurred in recent years. The conditions have been created for the increase of the role and responsibility of departments in the management of scientific research, steps have been taken on the improvement of the personnel potential, the staff of the Presidium of the USSR Academy of Sciences is being renewed, and the rights of institutes have been broadened.

However, these prerequisites and the proclaimed goals and principles for the present are being implemented slowly and in an unconvincing manner. Restructuring has affected only the top unit of the structure of the academy. The taken steps in a number of cases bear a tinge of half-heartedness. They have not yielded the anticipated results in the creation of the conditions for the most complete revelation of the creative potential of all scientists and have not led so far to the appreciable rejuvenation of the staff of the academy and the management of many of its institutes.

The implementation of new organizational steps on the increase of the practical return from the decisions made at the academy is, so it seems to me, a vital task.

An enormous, if not to say a decisive role in the work belongs to the party organizations of academic institutions. The essence of the matter in many respects depends on whether the party organizations of institutes will actually be able to head the restructuring of academic life, to involve the entire collective and every scientist in it, and to ensure the correct vision of the tasks as applied to every institute. Without the active support of scientific collectives and without the vigorous participation of scientists themselves in the work, which is aimed at the real change of the state of affairs, any, even the most vigorous actions of the management of the academy, as is clear, are doomed in advance to fail.

The democratic traditions of our Academy of Sciences are well known. However, this does not mean that there is no room here for the further democratization of the life of scientific collectives. This question merits the most serious attention not only because it is a matter of a most important subject—the means of developing basic science, but also because an enormous mass of people—more than 420,000—work in the academic system, while the results of their labor are of the greatest importance for our entire country.

The price of questions of organization and management here is increasing significantly. Omissions and miscalculations in these questions are expensive for society. Precisely the further democratization of the life of the academy and precisely informal glasnost will help not only to determine reliably the goals and tasks in the work, but also to enlist in the management of scientific collectives and various organizational structures of the academy new forces and competent people with organizing abilities, who have not only professionalism, but also

the necessary moral qualities, group around themselves scientific youth, and provide all the conditions for the establishment and development of genuine scientific schools.

Modern science cannot develop without fruitful debates and the extensive sharing of opinions. Today a stately monopoly on the truth is intolerable.

Life has more than once convinced us that only by relying on collective experience and by developing the civic and social activity of every scientist is it possible to develop correct approaches and means of increasing the efficiency of science, which conform to the spirit of the times.

At present—and this has also been spoken about here—a document, which is called upon to specify the prospects of development of the USSR Academy of Sciences, is being prepared. It is proposed to reflect in it all the directions of its activity, to incorporate new principles of work, and to specify more precisely the role and place of the academy in the sociocultural and economic spheres.

The formation of a new scientific organizational mechanism, in particular, should touch in earnest upon the questions of the development of academic institutions in the union republics and at the regional departments of the academy.

At present the number of institutes and scientists, for example, at republic academies, as a whole is comparable to the corresponding indicators of the USSR Academy of Sciences. The scientists of a number of republic academies have obtained considerable results, which constitute the pride of Soviet science. At the same time in recent decades in the activity of several republic academies a decline of creative activity has emerged and the amount of scientific research, which has been performed at a modern level, has begun to decrease. The aspiration for isolation and excessive enthusiasm for applied developments to the detriment of basic science have appeared, a serious lag of the scientific and social infrastructure has emerged. Striking irregularities and misalignments in the material, technical, and manpower supply of individual institutes and other subdivisions of the academy are occurring.

The Presidium of the USSR Academy of Sciences until recently was not devoting proper attention to the academies of sciences of the union republics. The coordination of scientific research and the integration of scientific forces in the most important directions were carried out poorly. And today, despite the restructuring that has begun at the USSR Academy of Sciences and the academies of sciences of the union republics, thus far appreciable results do not yet exist here.

The departments of the USSR Academy of Sciences and the academies of sciences of the union republics are in no hurry to use the opportunities afforded to them in the coordination and supervision of the corresponding institutes under the new conditions of management.

The recently adopted decree of the CPSU Central Committee and the USSR Council of Ministers on the increase of the role of republic organs in the management of national economy also makes it incumbent to look in a new way at the problem of the development of academic science at its various levels. It is a question of finding, as was already stated here, the optimum combination of all-union, republic, and regional programs of scientific research, of uniting for these purposes the efforts of academic, VUZ, and sectorial science, of taking decisive steps on the improvement of the material and technical supply of scientific institutes, and so on.

The accomplishment of the new difficult tasks, which face the academy, is impossible without the pursuit of a purposeful personnel policy. Certain positive trends are now appearing in this direction. Important sections of academic activity are being reinforced with personnel, the activity of the party organizations of institutions and institutes and of the Presidium of the USSR Academy of Sciences in the settlement of personnel questions has increased. More democratic principles of the appointment by election of the managers of structural subdivisions are being introduced, glasnost is being expanded. The adopted decision on personnel in the system of the Academy of Sciences is of fundamental importance here.

However, its implementation is processing slowly, and at times simply inconsistently. Often the basic attention in the pursuit of personnel policy is directed to the formal aspect of the matter. In a number of collectives the struggle of groups and directions for the exclusive right to the truth is continuing. Time-servers and operators from science are thriving.

Far from everyone has yet been convinced that the development of democracy in science is also the firm establishment of high moral principles in the scientific sphere, that the ultimate essence of the transformations, which were begun after April 1985, should lead to the restoration of morality everywhere and in everything as an indefeasible law of our life, and that such moral principles as responsibility, professional competence, and collectivism should be filled with a new content. In this connection it should be particularly stressed that the moral psychological aspects of restructuring and the creation in collectives of an atmosphere of genuine scientific creativity should become an object of the priority attention of party organizations.

Following the lessons of the truth, which the party teaches us, in scientific debates and the settlement of organizational questions, in the determination of priorities, and in personnel matters we should perform work

at the highest level of sincerity and objectivity, which, as is known, are acquired not in declarations and orders, but in scientific debates and are checked in action.

I believe that it is possible to be confident that the Soviet Academy of Sciences will do everything in order to ensure, as was stressed at the June CPSU Central Committee Plenum, "a fundamental breakthrough on the theoretical front, which is based on the strict analysis of the facts of social life and on the scientific substantiation of the goals and prospects of our movement" and which we vitally need.

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Candidates for Vacancies at Estonian Academy of Sciences

18140068 Tallinn SOVETSKAYA ESTONIYA in Russian 28 Oct 87 p 3

[Article: "From the Estonian SSR Academy of Sciences"]

[Text] The Presidium of the Estonian SSR Academy of Sciences reports that the following candidates have been registered for vacancies of members of the academy, which were announced on 24 September 1987:

For the Physics and Astronomy Department 1. Academician in the specialty "Physics"

Cheslav Bronislavovich Lushchik, corresponding member of the Estonian SSR Academy of Sciences, doctor of physical mathematical sciences, professor, head of the Laboratory of Ionic Crystals of the Institute of Physics of the Estonian SSR Academy of Sciences—recommended by the Council of the Institute of Physics of the Estonian SSR Academy of Sciences;

Peeter Maanuyevich Saari, corresponding member of the Estonian SSR Academy of Sciences, doctor of physical mathematical sciences, director of the Institute of Physics of the Estonian SSR Academy of Sciences—recommended by the Council of the Institute of Physics of the Estonian SSR Academy of Sciences;

Vladimir Vasilyevich Khizhnyakov, corresponding member of the Estonian SSR Academy of Sciences, doctor of physical mathematical sciences, professor, chief scientific associate of the Laboratory of Solid State Theory of the Institute of Physics of the Estonian SSR Academy of Sciences—recommended by the Council of the Institute of Physics of the Estonian SSR Academy of Sciences.

2. Corresponding member in the specialty "Physics"

Georg Georgiyevich Liydya, doctor of physical mathematical sciences, chief scientific associate of the Laboratory of Chemical Physics of the Institute of Chemical and Biological Physics of the Estonian SSR Academy of Sciences—recommended by the Council of the Institute of Chemical and Biological Physics of the Estonian SSR Academy of Sciences;

Mart Aleksandrovich Elango, doctor of physical mathematical sciences, professor, head of the Laboratory of X-Ray Spectroscopy of the Institute of Physics of the Estonian SSR Academy of Sciences—recommended by the Council of the Institute of Physics of the Estonian SSR Academy of Sciences.

3. Corresponding member in the specialty "Biophysics"

Rikhard Leo-Endelevich Villems, doctor of biological sciences, director of the Republic Biological Center for Gene and Cell Engineering attached to the Estonian SSR Academy of Sciences—recommended by the Council of the Institute of Chemical and Biological Physics of the Estonian SSR Academy of Sciences.

4. Corresponding member in the specialty "Molecular Biology"

Artur Yakobovich Lind, doctor of biological sciences, head of the Department of Molecular Biology of the scientific research section of Tartu State University—recommended by the Council of Tartu State University.

For the Information Science and Technical Physics Department

5. Academician in the specialty "Information Science"

Enn Kharaldovich Tyugu, corresponding member of the Estonian SSR Academy of Sciences, doctor of technical sciences, professor, academician secretary of the Information Science and Technical Physics Department of the Estonian SSR Academy of Sciences—recommended by the Council of the Institute of Cybernetics of the Estonian SSR Academy of Sciences.

6. Academician in the specialty "Mechanics"

Khillar Karlovich Aben, corresponding member of the Estonian SSR Academy of Sciences, doctor of technical sciences, director of the Institute of Cybernetics of the Estonian SSR Academy of Sciences—recommended by the Council of the Institute of Cybernetics of the Estonian SSR Academy of Sciences.

7. Corresponding member in the specialty "Power Engineering"

Lembit Arsenyevich Krumm, doctor of technical sciences, professor, head of the Department of Power Engineering of the Institute of Thermal Physics and Electrophysics of the Estonian SSR Academy of Sciences—recommended by the Council of the Institute of Thermal Physics and Electrophysics of the Estonian SSR Academy of Sciences and Academician of the Estonian SSR Academy of Sciences I.P. Epik.

For the Chemical, Geological, and Biological Sciences Department

8. Academician in the specialty "Geology"

Dimitriy Leonkhardovich Kalo, corresponding member of the Estonian SSR Academy of Sciences, doctor of geological mineralogical sciences, professor, director of the Institute of Geology of the Estonian SSR Academy of Sciences—recommended by Academician of the Estonian SSR Academy of Sciences K.K. Rebane;

Anto Viktorovich Raukas, corresponding member of the Estonian SSR Academy of Sciences, doctor of geological mineralogical sciences, professor, academician secretary of the Chemical, Geological, and Biological Sciences Department of the Estonian SSR Academy of Sciences—recommended by the Council of the Institute of Geology of the Estonian SSR Academy of Sciences.

9. Academician in the specialty "Organic Chemistry"

Viktor Alekseyevich Palm, corresponding member of the Estonian SSR Academy of Sciences, doctor of chemical sciences, professor, head of the Chair of Organic Chemistry of Tartu State University—recommended by the Council of Tartu State University.

10. Corresponding member in the specialty "Plant Physiology"

Udo Voldemarovich Margna, doctor of biological sciences, chief scientific associate of the Department of Plant Physiology and Biochemistry of the Institute of Experimental Biology of the Estonian SSR Academy of Sciences—recommended by the Council of the Institute of Experimental Biology of the Estonian SSR Academy of Sciences;

Oskar Yaanovich Priylinn, doctor of biological sciences, director of the Institute of Experimental Biology of the Estonian SSR Academy of Sciences—recommended by Academicians of the Estonian SSR Academy of Sciences I.G. Eykhfeld, A.I. Pung, and O.G. Eyzen.

For the Social Sciences Department

11. Academician in the specialty "Economics"

Raymund Rudolfovich Khagelberg, corresponding member of the Estonian SSR Academy of Sciences, doctor of economic sciences, professor, chief scientific secretary of the Presidium of the Estonian SSR Academy of Sciences—recommended by the Council of the Institute of Economics of the Estonian SSR Academy of Sciences.

12. Academician in the specialty "Philosophy"

Yaan Karlovich Rebane, corresponding member of the Estonian SSR Academy of Sciences, doctor of philosophical sciences, professor, head of the Sector of Philosophy of the Institute of History of the Estonian SSR Academy of Sciences—recommended by the Bureau of the Estonian Department of the USSR Philosophical Society and the Council of the Institute of History of the Estonian SSR Academy of Sciences.

13. Corresponding member in the specialty "Economics"

Uno Iokhannesovich Mereste, doctor of economic sciences, professor, head of the Chair of Statistics of Tallinn Polytechnical Institute—recommended by the Council of Tallinn Polytechnical Institute;

Reyn Augustovich Otsason, doctor of economic sciences, director of the Institute of Economics of the Estonian SSR Academy of Sciences—recommended by the Council of the Institute of Economics of the Estonian SSR Academy of Sciences.

14. Corresponding member in the specialty "Philosophy"

Andrus Albertovich Pork, doctor of philosophical sciences, professor, head of the Sector of Sociopolitical Research of the Estonian SSR Academy of Sciences—recommended by the Bureau of the Estonian Department of the USSR Philosophical Society;

Mikk Kharriyevich Titma, doctor of philosophical sciences, professor, head of the Sector of Social Structure of the Institute of History of the Estonian SSR Academy of Sciences—recommended by the Council of the Institute of History of the Estonian SSR Academy of Sciences.

15. Corresponding member in the specialty "Philology"

Yuriy Mikhaylovich Lotman, doctor of philological sciences, professor of the Chair of Foreign Literature of Tartu State University—recommended by the Council of Tartu State University;

Endel Iokhanovich Nirk, doctor of philological sciences, writer—recommended by the Presidium of the Board of the Estonian SSR Union of Writers;

Valdek Yokhannesovich Pall, doctor of philological sciences, head of the Sector of Dialectology of the Institute of Language and Literature of the Estonian SSR Academy of Sciences—recommended by the Council of the Institute of Language and Literature of the Estonian SSR Academy of Sciences.

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Scientometrical Analysis of Staff of Siberian Department

18140038 Moscow VOPROSY ISTORII YESTESTVOZNANIYA I TEKHNIKI in Russian No 3, Mar 87 pp 23-31

[Article by S.A. Krasilnikov (Novosibirsk): "The Scientometrical Analysis of the Personnel Composition of the Siberian Department of the USSR Academy of Sciences"]

[Text] In the total set of historical disciplines in the past decade the attention to source study has been increasing. This interest is explained by the fact that historical sources create a reliable foundation for the reconstruction of events and processes of the past. One of the means of the intensive use of sources is the search for the principles and methods of increasing their information yield [1].

The methods of other sciences, including quantitative methods, are being used extensively in modern source study. Quantitative methods are being used most effectively in history for the analysis of mass sources, making it possible to reveal not only the information that is directly expressed in them, but also latent, so-called structural information.

In the article the collection, which contains information on the full members and corresponding members of the USSR Academy of Sciences, who form its Siberian Department (SO AN SSSR), acts as the subject of study [2].

The publication in question, which came out in 1982, was intended for the meeting of practical needs: to give a sum of biographic information on members of the Siberian Department of the USSR Academy of Sciences during the 25 years of its existence and information that reflects the great scientific and sociopolitical potential of the detachment of leading scientists of the department. But the information included in the reference work, having fulfilled its immediate purpose, acquired with time a different quality: it became in the full sense of the word historical information, which makes it possible to judge the structure and dynamics of this unit of scientific personnel of the Siberian Department of the USSR Academy of Sciences within a specific chronological framework (1957-1982). The previously gained experience of the statistical analysis of scientific personnel of the USSR was taken into account in the search for means of formalizing the text files of the publication. The reference work "Nauchnyye kadry RSFSR" [Scientific Personnel of the RSFSR] (Moscow, 1930), which was attractive not only for its thoroughness (in it there are 34 tables, from which it is evident how scientists are distributed by regions, place of work, skills, party affiliation, and other attributes), but also for the principles of grouping within the category "scientists," aroused particular interest. This category was divided into three groups: the basic group—the total body of scientists; beginning researchers; outstanding and honored scientists (about 500 people, which came to 3.3 percent of the total number of scientific personnel of the country in 1928) [3]. All three groups underwent statistical analysis on common bases, which enabled the compilers of the reference work to show along with the social and professional makeup of leading scientists their place in the structure of scientific personnel, as well as their role in the process of the formation of the Soviet scientific intelligentsia and in the assurance of the continuity of the development of scientific research in the country.

The above-indicated methodological premise—when examining the personnel component of the scientific potential to take into account in interconnection all the skills groups from leading to beginning scientists—has still not been fully implemented as applied to the study of the scientific personnel of the Siberian Department of the USSR Academy of Sciences. And although a certain step forward in the elaboration of this theme was taken in the book of A.K. Romanov, L.A. Androsova, and A.F. Felinger [4], the exclusion from the object of study of the detachment of scientists of the highest skills—academicians and corresponding members of the USSR Academy of Sciences, who perform work at scientific research institutions of the region—to a certain extent decreased its significance.

Meanwhile precisely these scientists constituted the nucleus of the scientific collectives of the department a quarter century ago. At the present stage of the activity of the Siberian Department, when the staffs of scientist-organizers of "the second generation," who were formed already directly at institutes of the department, are playing a greater and greater role, the turning to historical experience in the matter of solving the problem of ensuring continuity in the work of "scientists of all generations and ranks" [5, p 164] is urgent. Academician M.A. Lavrentyev saw precisely in the passing on of this experience a guarantee of the creative development of the scientific collectives of the department in the future.

Until recently the study of the highest unit of scientific personnel was complicated due to the lack of aggregate data on the number, composition, territorial distribution, and sources of reinforcement of the members of the Siberian Department of the USSR Academy of Sciences during the entire period of its existence. With the appearance of the anniversary publication, which contains uniform biographic data that lend themselves to standardization and processing, the opportunity appeared to create a kind of "collective biography" of prominent scientists and to show the influence of various historical events on their paths in life [6]. Here we considered it possible to focus attention on the base characteristics which contribute to the process of the formation and creative growth of the scientist.

The first group of characteristics of the occupational mobility of members of the Siberian Department of the USSR Academy of Sciences pertains to what is called the "pre-Siberian Department" period of activity of scientists (the time and place of the obtaining of a higher education, the nature and place of work at the moment of transfer to the Siberian Department of the USSR Academy of Sciences), the second group of characteristics pertains to their work within the department (the number, the breakdown by fields of sciences and scientific centers, and so on).

During the 1st year after the adoption in May 1957 of the government decision on the establishment of the Siberian Department of the USSR Academy of Sciences the Presidium of the USSR Academy of Sciences took the most important steps, which were aimed at the formation of the personnel potential of the new academic institutes in the eastern part of the country, enlisting for work at them talented scientists who were organizers of science: they were afforded the opportunity to be candidates for full members and corresponding members of the USSR Academy of Sciences specifically for vacancies

of the Siberian Department. During the first election, which was held on 28 March 1958, the General Assembly of the USSR Academy of Sciences elected a large group of scientists (8 academicians and 27 corresponding members of the USSR Academy of Sciences), who had expressed the desire to work at the academic institutes being newly established on the territory of Siberia and the Far East (prior to the organization in 1971 of the Far Eastern Scientific Center [DVNTs] of the USSR Academy of Sciences the members of the Academy of Sciences, who worked in the Far East, also belonged to the Siberian Department).

The Siberian Department was the first territorial department in the history of the domestic Academy of Sciences, which united full members and corresponding members of the USSR Academy of Sciences, who were performing constant basic work at scientific institutions of Siberia (not only academic, but also department) and at the same time belonged to other departments of the USSR Academy of Sciences in conformity with their specialty. Upon departure for a basic job at institutions outside Siberia the members of the USSR Academy of Sciences on the decision of the General Assembly of the Siberian Department either cease to be members of the department or remain members of it in case of the maintenance of close contacts with the department and participation in its work [2, p 6].

After 1958 the reinforcement of the staff of the Siberian Department took place within the framework of general elections at the USSR Academy of Sciences either for special vacancies of the Siberian Department of the USSR Academy of Sciences as well or for vacancies in the departments by fields of science. The results of the elections are presented in Table 1.

Table 1. The Reinforcement of the Staff of the Siberian Department of the USSR Academy of Sciences

Election years	Academicians	Corresponding members
1960	—	8
1962	—	2
1964	4	14
1966	7	8
1968	7	16
1970	3	9
1972	1	4
1974	1	1
1976	—	10
1979	2	11
1981	10	15

In all during the elections of members of the Academy of Sciences from 1958 to 1981 the staff of the Siberian Department was reinforced by 138 scientists, including (in addition to those elected) M.A. Lavrentyev, S.L. Sobolev, S.A. Khristianovich, and N.P. Dubinin.

From 1958 to 1981 elections of academicians and corresponding members of the USSR Academy of Sciences for vacancies of the Siberian Department were held 12 times. Within the period being studied the grouping of scientists by the time of election as members of the Academy of Sciences and, consequently, as members of the Siberian Department of the USSR Academy of Sciences was made in the following manner: those elected during 1958-1952, during 1964-1968, during 1970-1974, and during 1976-1981.[1] The noted periods as a whole conform to specific stages of the internal development of the Siberian Department, reflecting the phases of the formation of the personnel potential. Here the first years (1958-1962) were the time of the formation of the nucleus of the department—the scientific institutions of the Novosibirsk Scientific Center, after which the subsequent development of the large scientific complexes of the Siberian Scientific Center was carried out on its own basis. The majority of those elected full members and corresponding members of the USSR Academy of Sciences during 1964-1968 worked at the Novosibirsk group of institutes of the department. At the turn between the 1960's and 1970's the intensive development of scientific institutions of the Siberian Department of the USSR Academy of Sciences outside Novosibirsk begins, which finds reflection in the increase of the number of members of the USSR Academy of Sciences, who work at affiliates. This trend accompanies all the subsequent elections, which were held during 1970-1974 and 1976-1981.

Let us examine below a number of base characteristics, which governed the formation of scientists (Table 2).

Table 2. The Breakdown of Members of the Siberian Department of the USSR Academy of Sciences by the Time of Graduation From a Higher Educational Institution

Years of graduation from a higher educational institution	Elected during 1958-1962	1964-1968	1970-1974	1976-1981
Before 1920	2	—	—	—
1921-1925	8	1	—	—
1926-1930	15	2	1	—
1930-1935	10	5	—	1
1936-1940	6	9	1	—
1941-1945	2	7	2	1
1946-1950	1	6	3	5
1951-1955	—	9	6	19
1956-1960	—	1	1	7
1961-1965	—	—	1	3

The bulk (about 50 percent) of the scientists of the first group, who were elected during 1958-1962, received a higher education at the turn between the 1920's and

1930's, between 1929 and 1933. Scientists, who graduated from higher educational institutions between 1936 and 1943 (40 percent), as well as during 1947-1955 (37.5 percent), were typical among the second group (those elected during 1964-1968). The war contributed to the fact that scientists, who received a higher education during 1944-1946, were absent in this group. Among scientists of the third group (those elected during 1970-1974) approximately half graduated from higher educational institutions during 1951-1955. Of the scientists of the fourth group 53 percent received a higher education during the same time period. Moreover, 25 percent of all the scientists elected during the last period graduated from higher educational institutions between 1957 and 1963, having acquired a real opportunity to be assigned to a job at the Siberian Department immediately after acquiring a VUZ specialty.

The shortening of the time period from the moment of graduation from a higher educational institution and election as members of the Academy of Sciences with the rank of corresponding members from 30-35 years (for the group of 1958-1962) to 20-25 years (for subsequent groups) is the general trend. Thus, the established department was a powerful factor, which influenced the acceleration of the skills and job advancement of scientists who came into the field of its "attraction."

In Table 3 several trends are clearly traced. Moscow played earlier and continues to play the role of the basic city, where future members of the Siberian Department of the USSR Academy of Sciences have been trained. The gradual increase of the proportion of members of the Siberian Department of the USSR Academy of Sciences, who received an education already in Siberia, mainly in Tomsk and Irkutsk, from 20 percent in the first group to 29 percent in the last attracts attention.

Table 3. The Breakdown of Members of the Siberian Department of the USSR Academy of Sciences by the Place of the Obtaining of a Higher Education, percent

City, region	Elected during 1958-1962	1964-1968	1970-1974	1976-1981	Total during 1958-1981
Western regionsof the country	80	83	75	64	78
including:					
Moscow	22	56	40	30	40
Leningrad	52	15	15	20	26
other cities of theEuropean party of the USSR	6	12	20	14	12
Eastern regions of the country	20	17	25	36	22
including:					
Western Siberia	14	2	15	26	13
Eastern Siberia	6	10	10	3	7
Far East, Central Asia	—	5	—	7	2

More than half of the members of the Siberian Department of the USSR Academy of Sciences received a university education (51 percent). In all 13 percent graduated from polytechnical institutes, 16 percent—from other higher educational institutions of the technical type, 8 percent—from mining and geological higher educational institutions, 7 percent—from medical, economic, and pedagogical higher educational institutions, and 5 percent—from agricultural higher educational institutions. During all the years 32 people graduated from Moscow State University, 16—from Leningrad State University, and respectively 6 each—from Tomsk and Irkutsk universities. Among polytechnical higher educational institutions the main "suppliers" of members of the Siberian Department of the USSR Academy of Sciences were Tomsk Polytechnical Institute (10 people) and Leningrad Polytechnical Institute (6 people). Eight people graduated during different years from the Leningrad Mining Institute and four people each graduated from the Moscow Physical Technical Institute and the Moscow Chemical Technology Institute.

The next characteristics are connected with the identification of the location of scientists on the eve of their transfer to a job at the Siberian Department of the USSR Academy of Sciences (Table 4).

Table 4. The Territorial Distribution of Scientists at the Moment of Transfer for the Siberian Department of the USSR Academy of Sciences, percent

City, region	Elected during 1958-1962	1964-1968	1970-1974	1976-1981	Total for 1958-1981
Western regions of the country including:	80	77	72	56	71
Moscow	60	58	50	31	50
Leningrad	11	11	8	10	10
other cities of the European part of the USSR	9	8	14	15	11
Eastern regions of the country including	20	23	28	44	29
Western Siberia	15	3	14	34	13
Eastern Siberia	3	17	14	10	13
Far East	2	3	—	—	3

The data testify that during the first 10-15 years the department was manned with prominent scientists of the management level first of all at the expense of Moscow and Leningrad. In the past decade the role of the Siberian Region as a territorial source of the formation of personnel of the highest skills has been emerging noticeably. Thus, there is a high correlation between two attributes—the place of the obtaining of a higher education and the place of work of the scientist at the moment of transfer to the Siberian Department of the USSR Academy of Sciences.

It is also no less important to establish in which of the three "sectors" of science (sectorial, VUZ, academic) the scientists were working at the moment of transfer to the Siberian Department (Table 5). The prevalence of "immigrants" from institutions of the USSR Academy of Sciences (on the average up to 50 percent of the last groups) is the typical trend, which has been modified somewhat in recent years.

Table 5. The Breakdown of Scientists by "Sectors" of Science at the Moment of Transfer to the Siberian Department of the USSR Academy of Sciences, percent

Sector of science	Elected during 1958-1962	1964-1968	1970-1974	1976-1981	Total for 1958-1981
Institutes of the USSR Academy of Sciences	60	35	47	41	44
Higher educational institutions	19	30	20	48	27
Sectorial scientific research institutes, enterprises	21	35	33	11	29

Of the academic and sectorial institutes the largest reinforcement of the nucleus of management personnel for the Siberian Department was provided by the Institute of Atomic Energy (nine people) and the Institute of Chemical Physics (six people). The Moscow Chemical Technology Institute proposed a group of scientists (four people). In the Siberian Region the largest number of members of the academy became prominent researchers, having been in science teaching work at Tomsk Polytechnical Institute and Tomsk University (10 people). The management personnel of the West Siberian and East Siberian affiliates of the USSR Academy of Sciences were another source.

A high degree of mobility (the transfer in the process of scientific activity from one sector of science to another) was characteristic of the older generation of scientists, which formed during the prewar years. A large group of representatives of natural science disciplines acquired invaluable experience of coordination and interaction, which came in useful when establishing the Siberian Department, in the implementation of the most important comprehensive scientific and technical programs in the 1940's and 1950's. The noted mobility is less characteristic of the subsequent generations of scientists who came to the Siberian Department. However, the existence of the closest interconnection between the social institutes of science and higher education was a common trait: practically all the scientists combined scientific work with teaching work, thereby creating the foundation for the formation of scientific schools within the Siberian Department.

The analysis of the above-cited data on the "pre-Siberian Department" activity of academicians and corresponding members, who were elected members of the Siberian Department in different years, fully characterizes the fact that the establishment of the Siberian Department of the USSR Academy of Sciences was a truly revolutionary step in the matter of developing the organization of science in our country. The department played and is now continuing to play the enormous positive role of a "catalyst" of the interregional migration of scientific personnel, on the one hand (the influx of personnel of the highest level from the center for permanent work in the East and Siberia, which is unprecedented in the history of domestic science), and transfers of personnel of science between its sectors, on the other.

The following data testify to the quantitative and structural changes of the detachment of members of the Siberian Department of the USSR Academy of Sciences. Following the 1958 election to vacancies of the department in it with allowance made for the 3 academician organizers there were 39 members (11 academicians and 28 corresponding members of the USSR Academy of Sciences), which came to about 8 percent of the total number of members of the USSR Academy of Sciences. By 1982, 77 members (23 academicians and 54 corresponding members) worked in Siberia. The twofold

increase of the number of academicians and corresponding members also raised the proportion of the detachment of scientists of Siberia among the members of the USSR Academy of Sciences to 11 percent.

The specific increase of its share both in the total number of members of the USSR Academy of Sciences and in different fields of science was a reflection of the increased authority and scale of activity of the collectives of scientists of the Siberian Department. The change was first of all achieved due to the increase of the groups of scientists, the members of the Siberian Department of the USSR Academy of Sciences, and, among members of the USSR Academy of Sciences, the representatives of the physical mathematical, technical, and biological sciences.

The data cited in Table 6 testify to the change in the composition of the members of the Siberian Department from the standpoint of their breakdown during different years by fields of sciences [2, p 7].

Table 6. The Proportion of Members of the Siberian Department of the USSR Academy of Sciences in the Total Number of Members of the USSR Academy of Sciences and With a Breakdown Among Fields of Sciences, percent

Fields of sciences	1960	1970	1980
Physical mathematical and technical	6.7	12.2	13.4
Earth sciences	29.0	22.0	18.6
Chemical	10.1	8.1	6.9
Biological	—	6.4	7.8
Social	1.8	3.4	3.3
All fields	8.1	10.5	10.7

If we compare the present composition of the Siberian Department of the USSR Academy of Sciences with the initial sectorial composition of 1958, it is possible to reveal that its dynamic change occurred in subsequent years: given the increase of the total number of scientists, who represented all fields of sciences, the increase of the number of members of the USSR Academy of Sciences for the Siberian Department, who represented the biological, physical mathematical, and technical sciences, was accomplished at a leading pace.

With the growth of the department a certain smoothing of the irregularity in the territorial distribution of its members is occurring. Whereas in 1964 the share of members of the department, who were working at institutes of the Siberian Department of the USSR Academy of Sciences outside Novosibirsk, came to 13 percent, then the proportion of this group increases (25 percent in 1970 and 32 percent in 1982),[2] being a reflection of the concentration of efforts of the Presidium of the Siberian Department of the USSR Academy of Sciences on the strengthening of the scientific institutions located in Irkutsk, Krasnoyarsk, Yakutsk, Ulan-Ude, and Tomsk. At the beginning of 1985 this group was represented by 31 members of the department, among whom there are 10 academicians.

Along with this the Novosibirsk Scientific Center continues to hold the dominant role in the development of the Siberian Department of the USSR Academy of Sciences: at the beginning of 1985 about half of all themembers of the Siberian Department, or nearly 7 percent of the total number of academicians and corresponding members of the USSR Academy of Sciences, worked at it. The members here of the USSR Academy of Sciences are in nearly all (13 of 16) of its departments for sciences (Table 7), moreover, in the Geology, Geophysics, and Geochemistry Department, the Mechanics and Control Processes Department, the General Physics and Astronomy Department, and the Mathematics Department one-tenth work at the Novosibirsk Academy Campus.

Table 7. The Breakdown of Members of the USSR Academy of Sciences, Who Are at the Siberian Department, by Fields of Sciences, percent

Fields of sciences	1958	1964	1970	1976	1979	
Physical mathematical and technical sciences	43.6	46.6	48.7	51.8	52.2	
Earth sciences	33.3	30.0	27.0	27.0	22.9	22.3
Chemical	15.4	13.4	12.2	14.3	12.3	
Biological	2.6	1.6	4.8	6.0	7.7	
Social	5.1	8.4	7.3	6.0	5.5	

There are two sources of the formation of the contingent of members of the Siberian Department of the USSR Academy of Sciences, which ensure the department both continuity and dynamism. One of them (the external source) contributes to the influx to the department of mature, prominent scientists for the management of some scientific directions or others. The development of scientific personnel within the institutions of the department is the other (the internal source). The following data (Table 8) testify to their ratio during different periods.

Table 8. The Time of Work at the Siberian Department of the USSR Academy of Sciences at the Moment of Election as Corresponding Members of the USSR Academy of Sciences, percent

	Elected during			
Time of work at the department, years	1958-1962	1964-1968	1970-1974	1976-1981
Less than 3	100	16	20	15
3-5	—	13	9	4
5-7	—	30	9	—
7-10	—	41	20	9
More than 10	—	—	42	72

Up until 1964 the increase of the members of the department was accomplished entirely by means of the influx from without. The "self-reinforcement" of the members of the department began in 1964 and then became the dominant process: according to the data for

1984, nearly 80 percent of the present members of the department precisely within its scientific institutes began their advancement from the rank of senior and junior scientific associates. A portion of them at the moment of arrival at the department did not have academic degrees.

The statistical analysis made from from point of view testifies to the formation and effect of the mechanism, which ensures the dynamic and stable increase of scientific personnel and acts as the logical completion of the entire system of the training of personnel for the sphere of science at the Siberian Department of the USSR Academy of Sciences.

Thus, by using the simple techniques of statistical groupings, it is possible to describe a number of structural characteristics and the dynamics of the highest skills detachment of scientists—members of the department for 25 years.

As compared with the first 5-year period this group today has doubled in number, now one-tenth of the members of the union Academy of Sciences are directly members of the department or are taking part in its work. The sectorial structure has stabilized, the disproportions in the territorial distribution of members of the department have been smoothed out, the demographic indicators of this group are stable.

The retrospective analysis also makes it possible to a certain extent to draw the conclusion that the Siberian Department of the USSR Academy of Sciences, which was examined from the standpoint of the dynamics of scientific personnel of the highest skills, is at the stage of evolutionary development: a kind of revolutionary leap, which is connected with the formation in the 1950's and 1960's of a new type of scientist who combines a trinity of qualities (researcher, organizer, educator), concluded during the first half of the 1970's with the formation of a group of scientists who completely satisfy the indicated requirements.

At the present stage the proportion of processes of stability as compared with processes of mobility has increased. This finds its reflection in the fact that now the Siberian Department of the USSR Academy of Sciences, which has a highly efficient multilevel system of the training and the subsequent assurance of the skills and job advancement of scientific personnel, is a kind of self-reproducing system, in which all the units—from the lowest to the highest—are being reinforced primarily by means of internal sources. Under these conditions the provision of the department with all types of occupational mobility in science for the purpose of organizing the influx of scientific personnel from without to all the levels of this system is an important task, for the consideration of which the enlistment on a more and more extensive scale of the information, which is contained in historical sources of various kinds, is expedient.

Footnotes

1. To avoid double counting the scientists, who were initially elected corresponding members and subsequently academicians of the USSR Academy of Sciences, were taken into account in the interval, to which their election as corresponding members and, consequently, the start of membership in the Siberian Department fell.

2. During the 1984 election the department was reinforced with 11 full members and 11 corresponding members of the USSR Academy of Sciences. See *Nauka v Sibiri*, 17, 24, 31 January, 7, 14, 21, 28 February 1985.

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Work of Nadezhnost mashin Interbranch Complex

18140071 Moscow NTR: PROBLEMY I RESHENIYA in Russian No 21, 3-16 Nov 87 p 4

[Article by Academician K.V. Frolov, general director of the Nadezhnost mashin Interbranch Scientific Technical Complex, and V.F. Kutenev, director of the Central Institute of Automobiles and Automobile Engines and manager of one of the units of the Nadezhnost mashin Interbranch Scientific Technical Complex, under the rubric "The Interbranch Scientific Technical Complex—Problems of Formation": "The Shifting of Resources"; first paragraph is *NTR: Problemy i Resheniya* introduction]

[Text] The "Achilles' heel" of our machine building is the inadequate reliability of items. The economy of the country is incurring enormous harm from it: the sphere of repair is swollen, the competitive ability is low, and so on. The work of the Nadezhnost mashin Interbranch Scientific Technical Complex is aimed at the elimination of these shortcomings. Born at the same time as the other complexes, it underwent substantial changes half a year ago. Academician K.V. Frolov, its general director, and V.F. Kutenev, director of the Central Institute of Automobiles and Automobile Motors and manager of one of the units of the interbranch scientific technical complex, tell what weak and strong points of the complex have appeared in this time.

K. Frolov

It has been half a year that the Nadezhnost mashin Interbranch Scientific Technical Complex has been working with a new, expanded composition. Organizations and enterprises, which together will be able to solve the problem of developing technical advanced and, what is the main thing, reliable machines, have been included in the complex. Here the questions of the reliability of specific items remain with the sectors, outside the functions of the interbranch complex. Its basic task is to provide the developers of new equipment with research tools.

Of course, everything begins with theory. The foundations of the analysis of the physical nature of failures and the calculation of their probability were built by the works of Soviet scientists. To make the method of calculating reliability convenient for any engineer of a design bureau is the job of the academic institutes that are a part of the interbranch scientific technical complex.

An important element of the assurance of the reliability of machines is the standard. Not the one that legitimizes the past of the development of equipment, but a mobile one that erects a barrier in the way of the production of nondurable items. The task is a difficult one. Beginning with the revision of terms and ending with the standardization of indicators, all the scientific and technical work in this area is being performed under the difficult conditions of the conflict of opinions of ministries and departments, producers and users of equipment, since the possibilities of the manufacturer far from always coincide with the requirements of the client.

Wherever there is quality control, there is also metrology. Unfortunately, we are not always capable of measuring even the basic indicators of machines. Today it is important to establish the out of balance of parts, the stressed state of metal, and so forth. Moreover, all these characteristics should be determined promptly, in the rhythm of production, by means of robots, so that subjective factors would not influence product quality. The possibility of the proper metrological support of the diagnostic and testing equipment being developed is finally being afforded. The development, for example, of primary transformers with high metrological characteristics is complicated without the participation of the same institutes of the State Committee for Standards.

The next chance to detect a mistake of designing is tests. Now we cannot venture to develop specimens of equipment for strength and service life under full-scale conditions, that is, during ordinary operation. This means to postpone for years the introduction of innovations. A reasonable solution is the development of methods and means of rapid tests.

Here it is important not simply to shorten the time of an experiment, but to bring the under-load conditions of machines close to the actual ones. Tests with control and the processing of the results on computer, of course, are more efficient—hence, the necessary programs for automated analysis have to be developed. But at times there are not enough of even elementary sensors and electronic instruments, which have to be produced in a primitive manner.

For the accomplishment of these tasks, as well as the automation of calculations, simulation, and the control of reliability it is necessary to develop algorithms and programs of the analysis of potential failures and their consequences. Packages of applied programs for the determination of the amount of repair of technological defects of domestic components will be developed by the forces of the organizations of our complex.

The last, but a very important unit of the "machine—reliability" problem is the training of skilled personnel. We are beginning not from scratch. Primarily experienced workers are employed at our pilot experimental bases and bays. But according to the requirements of today they should master perfectly advanced means of testing and methods of the automation of the planning of tests and control.

It is necessary to mobilize the higher school as much as possible for the training of domestic experimenters, research engineers, and mechanical engineers of a new type, who know how to use the entire arsenal of highly efficient means of diagnosis and testing, which are being

developed by the interbranch scientific technical complex. An educational research center based on the Moscow Higher Technical School imeni N.E. Bauman, the Spektr Intersectorial Scientific Production Association, and the State Scientific Research Institute of Machine Science imeni A.A. Blagonravov of the USSR Academy of Sciences has been organized for this. Next is the establishment of an educational research center by the forces of the Moscow Institute of Automobile Roads, the Central Institute of Automobiles and Automobile Engines, the Moscow Institute of Automotive Mechanics, and a number of other organizations.

It is extremely necessary for the solution of the problem of increasing the reliability of machines, which is urgent for our country, to provide machine building with advanced technologies and materials. The question of the drafting and introduction of a new statute on the interbranch scientific technical complex, which would make it possible to shift from the coordination to the actual management of research and development with the use of effective economic and other levers, has also become urgent. The interbranch scientific technical complexes should have their own assets and funds and dispose of them themselves for the strengthening of enterprises and organizations of the complex and the priority retooling of their pilot experimental and production base.

It is necessary to do everything in order to escape the mass production of spare parts and innumerable repairs by the development and extensive use of advanced diagnostic aids.

V. Kutenev

Our weakest link, perhaps, is in the tests of prototypes of machines. We spend years on bringing them up to the necessary condition and to the transfer of an item to production. The reason is the lack of methods of short-term, simulating tests and the poor supply of the experimental base with advanced stands and measuring equipment.

The Central Institute of Automobiles and Automobile Motors became a part of the interbranch scientific technical complex in April of this year. We see the significance of this reorganization first of all in the fact that the reliability of a motor vehicle as a finished product is formed from the reliability of items of many sectors of industry: metallurgy, chemistry, electronics, and so on. Thus, by developing equipment for the testing of a motor vehicle, we are thereby developing diagnostics in other sectors.

Something pleases us in the activity of the interbranch scientific technical complex, something causes anxiety, or else disenchantment. Let us begin, as usual, with the good.

We have to a significant degree "leveled" the barriers that separated sectors. Gathering together, we discuss common problems.

There are already also specific results of our joint activity. The work on the development of electrohydraulic machines and multichannel stands for the testing of materials, components, and unitized items of machine building for strength, reliability, and service life has been stepped up. The production of means of vibration diagnosis and X-ray instruments for the study of the structure and the elementary and phase composition of substances and the stress-strain state of materials and components and a number of other operations are being organized. However, the production volume and range of items cannot fully meet the needs for testing equipment.

We see a means to the rapid development of the experimental base of machine building in the expansion of cooperation on the production of components at the intrasectorial and intersectorial level with the enlistment of enterprises of the CEMA member countries, as well as in the unification of the basic assemblies of test stands and machines. If the output of type size series of unified equipment is ensured, we will give the user the opportunity to choose precisely which he needs with respect to power consumption, size, and other indicators.

But it is not enough to produce testing equipment. It is necessary that it would always be in working condition. For this it is necessary to organize at producer plants or outside them special subdivisions, something like cost accounting service firms. They can deal with the advertisement of new equipment, its installation, and "turnkey" delivery.

It seems that the suggestion of the State Scientific Research Institute of Machine Science imeni A.A. Blagonravov on the organization of specialized engineering centers for the reliability and service life of heavy, power, and electrical machines and for new technological processes, which are based on superductility, should be supported.

The tasks and the program of actions have been specified. Nevertheless the interbranch scientific technical complex with its present status is very reminiscent of a public organization. Within the complex one or another problem is discussed, but its specific solution is accomplished all the same through sectorial ministries. It is as if money is being given to us, but it is possible to obtain it once again only through ministries.

Financial hitches also exist outside the interbranch scientific technical complex. Here is a typical example. The Armavir Tochmashpribor Production Association required 1.5 million rubles for the development of a testing machine. Hence, the Ministry of the Automotive Industry and the Ministry of Instrument Making, Automation Equipment, and Control Systems should turn

over their own money to the association. But the distribution of the finished product will take place through the USSR State Committee for Material and Technical Supply, while it is not giving any guarantees that the ordered equipment will get precisely to us. For what will we be paying? It turns out that it is better to buy similar machines in the GDR—at 80,000 rubles a set. It would probably be more advisable for the Tochmashpribor Association with this turnover of many million rubles to get credit from the bank, to fill our order for the development, and then to pay back the loan by selling finished items.

The experimental equipment, which is produced by the interbranch scientific technical complex, should be competitive on the domestic and foreign markets. However, when drawing up technical assignment we often direct our attention to the prospectuses of foreign firms. Thus, a lag of 2-3 years is obviously being planned. Considerable blame for this rests with the State Committee for Science and Technology, since in accordance with its decree equipment, which if only with respect to some indicator is inferior to foreign equipment, is not permitted to be produced.

Such a policy does not take into account that capitalist firms at times insert in advertising what has not been achieved and what is desirable. And this "ideal" at times appears before us as an insurmountable wall. We should clearly specify what level of equipment we need, and not put the blame every time on the West. The council of main designers and experts was also formed in order to forecast the development of testing and diagnostic equipment and to evaluate objectively the technical level of the integrated product that is being developed.

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Research Achievements of Institute of Thermal Physics

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[Interview with Corresponding Member of the USSR Academy of Sciences V.Ye. Nakoryakov, director of the Institute of Thermal Physics of the Siberian Department of the USSR Academy of Sciences, by A.I. Margolin under the rubric "Conversations and Interviews": "The Academic Institute and Scientific and Technical Progress. A Conversation with V.Ye. Nakoryakov, Director of the Institute of Thermal Physics of the Siberian Department of the USSR Academy of Sciences"; date, place, and occasion not given; first paragraph is *Vestnik Akademii Nauk SSSR* introduction]

[Text] In 1987 the Siberian Order of Lenin Department of the USSR Academy of Sciences is 30 years old. A contemporary of the department—the Institute of Thermal Physics, of which Academician S.S. Kutateladze, a prominent scientist and Hero of Socialist Labor, was director for long years—was the first scientific institution of such a specialization. The editorial board addressed to Corresponding Member of the USSR Academy of Sciences V.Ye. Nakoryakov, the present director of the institute, the request to tell how the collective is combining scientific research with the practical application of its results and what its contribution is to scientific and technical progress of the country.

[Answer] Among other phenomena thermal physics studies microtransfers of energy and matter, which are accompanied by thermal effects. The spheres of theoretical experimental research in this field and of the corresponding technical applications in essence are unlimited. Turbulent transfers in homogeneous and heterogeneous media are the basic subjects of the research of the institute in the field of thermal physics proper and physical gas hydrodynamics. Here there are simply no problems that have been solved, in the precise sense of this word. But scientists of the institute have made a significant contribution to their statement and development. I believe that one should group with the recognized achievements the development of a hydrodynamic model of critical phenomena in gas (vapor)-liquid flows; asymptotic models of boundary layers with complex boundary conditions and in the presence of phase transitions and chemical transformations; methods of the generalization of experimental data about thermal, gas dynamic, and electromagnetic interactions in electric arc plasma generators; the study of the dynamics and energy interactions in nonequilibrium molecular flows.

At the institute a unique experimental base, which made it possible to study the processes of heat and mass exchange over a wide range of temperatures—from those of liquid helium (less than 4 degrees Kelvin) to temperatures on the order of 100,000 degrees Kelvin, which are characteristic of thermal gas plasma, and at speeds of flows—from very low ones, which are characteristic of high viscosity polymers, to ones that exceed by fivefold the speed of sound in a solid gas and by a hundredfold the speed of sound in free molecular flows, has been established. I will note that the thermal gas dynamic, hydrodynamic, and plasma chemical stands and the set of stands for the study of the thermal hydrodynamics of boiling cryogenic and high temperature heat transfer media in a subcritical and supercritical thermodynamic state, which we have, are making it possible already now to organize at the institute a number of collective-use centers. Here in accordance with special plans, which have been coordinate with the institute, staff members of a large number of sectorial scientific research institutes and design bureaus would be able to conduct research for the purpose of developing specific engineering designs. Such joint work would enrich with ideas and results both the basic research of the academic institute and specific developments in the latest fields of technology.

Significant experience of the interaction of basic and applied sciences has been gained at the Siberian Department of the USSR Academy of Sciences. It is also

possible to say the same thing about our institute. The majority of modern industrial technologies are developed on the basis of basic research, and here the inclusion of subdivisions, which are engaged in theoretical and experimental work, in the plan of activity of scientific technical complexes in industry serves as one of the decisive things. The Energokhimmash Special Design Bureau (since 1987 the Novosibirsk Affiliate of the Scientific Research Institute of Chemical Machine Building) of the Ministry of Chemical and Petroleum Machine Building and the Siberian Affiliate of the Tekhenergokhimprom Scientific Production Association of the Ministry of Mineral Fertilizer Production are operating under the scientific supervision of the institute. Both of these design and technological organizations, which were established in 1970, are cooperating closely with a number of institute laboratories and are conducting development and pilot industrial research on many technical and technological problems. Such cooperation, which is based on the principles of the continuity of the directions of research, the use of the scientific potential of the academic institute for the needs of industry, work in accordance with joint plans and programs, and the establishment of joint experimental groups and stands of common use, is having the result that a significant number of scientific results, which were obtained at the institute, are being implemented and are becoming the basis of various kinds of applications in power engineering (including atomic energy), power chemical technologies, plasma technology, instrument making, the solution of ecological problems, and so on.

Take if only the theoretical and experimental work, which was performed by the institute, on heat and mass transfer in single-phase and two-phase systems and in gas-liquid flows over a wide range of response characteristics in case of boiling, condensation, and bubbling; on the kinetics of high temperature processes, as well as the dynamics of rarefied gases.

We are dealing with two phase gas- and vapor-liquid flows in steam generators, atomic reactors, apparatus of chemical technology, and cryogenic engineering, in the petroleum- and gas-drilling industry, and in such natural phenomena as the eruption of volcanoes and geysers. The interacting, reacting ocean and atmosphere are also an example of a gas-liquid system. The research on the mechanics of gas-liquid systems, which is aimed first of all at the construction of a complete, physically valid model that reflects the main processes of the interaction of phases in a two-phase flow, can be used and is already being used for the development of refined standard methods of the calculation of the hydrodynamics and heat exchange of such flows in pipes. As an example of the applied developments of this direction I will name the use of gas-liquid flows and jets for the cleaning of fuel systems and the dimensional chemical etching of items made of aluminum and titanium alloys. The use of the new technology of etching makes it possible to speed up this process appreciably, to ensure an adequate dimensionality of the machining of the surface of parts, and to improve substantially the working conditions of attendants.

One of most serious emergencies, which threaten nuclear electric power plants, is the seal failure of the first circuit, through which the heat-transfer medium is pumped with a high temperature and under high pressure. During the first fractions of a second after the formation of a rupture or crack in the piping shock waves and waves of boiling appear, that is, transient processes, which determine the entire picture of the dynamic loads on the piping, form. The developed wave models make it possible to calculate effectively the levels of the pressures that occur in this case.

In case of the transportation of petroleum through pipes gas is often liberated, which also leads to the development of transient processes. Therefore, the calculation of the levels of pressure, which occur, in particular, during shutdowns and startups of a pipeline, should be based on wave models of two-phase systems. Such models make it possible to calculate the structure and dynamics of hydraulic shocks and on this basis to determine the necessary thickness of the walls of the pipeline and the metal content of the entire system.

During the construction of hydraulic structures and the deepening of lakes and river beds the problem of protecting the ichthyofauna against shock waves arises. One of the reliable means of such protection is the use of so-called bubble screens. The study of the structure of waves and the laws of their damping in bubble screens made it possible to develop the scientific principles for the proper choice of the parameters of the screens—their width, the gas content, and the radius of the bubbles.

The development of equipment and technology in our times requires the active use of high temperatures and great speeds and pressures, which are accomplished by means of small highly productive and easily automated devices. One of the means of accomplishing the posed task is the use of thermal plasma, with which the implementation of large-tonnage chemical and metallurgical processes, the application of all kinds of coatings to the surface of items, the conversion of production waste into a useful product, and the development of materials with preset physical chemical and mechanical properties are connected. In this direction the prospect of making many technological processes closed and thereby of coping with the global problem of protecting the environment against pollution and ensuring the complete processing of raw materials is also afforded.

The generation of thermal plasma for the majority of technological processes, especially large-tonnage processes, is being carried out today in electric arc plasma generators with a unit power from tens of kilowatts to 5-6 megawatts with high electric and heat efficiencies. On the basis of basic research on gas-discharge plasma

under the conditions of limited space and the interaction of plasma with solid surfaces, a gas flow, and external magnetic fields engineering methods of calculating the electrical, heat, and erosion characteristics of plasma generators of any power were developed at the institute under the supervision of Corresponding Member of the USSR Academy of Sciences M.F. Zhukov. A broad class of highly efficient plasma generators with a life of hundreds of hours, which meet the requirements of industry, was developed jointly with the Energokhimmash Special Design Bureau. Thus, the new generation plasma generators with a power of 50-200 kilowatts are intended for the obtaining of ultradispersed powders, the application of coatings, and other purposes. A plasma generator, which does not have analogs in world practice and operates successfully on currents with a power of up to 1 kiloampere with the use of various gases (air, oxygen, water vapor), was developed for the plasma machining of metal and the cutting of thick material. A 1.5-megawatt hydrogen plasma generator is intended for the conversion of toxic organochlorine waste into a useful product; this device can be used for the deep refining of petroleum for the purpose of increasing by 10 percent the yield of light fractions and for the plasma gasification of lignites of the Kansk-Achinsk basin.

A technology of obtaining weak nitric acid from air was developed on 50-kilowatt laboratory units (a completely automated unit of substantially greater power for its operation at one of the Siberian sovkhozes is being designed jointly with the Siberian Department of the All-Union Academy of Agricultural Sciences imeni V.I. Lenin).

The plasma chemical method of obtaining liquid nitrogen-phosphorus fertilizers—nitrophosphates—through the nitric acid extraction of phosphorites is also of interest (the basic amount of energy, which is vented by the unit with the waste gases, is recovered in the heat exchanger-water heaters for farm and household needs). The field tests of the fertilizers, which were obtained by such a method, showed their good quality. This technology, just as the technology of the plasma application of coatings to quickly wearing parts of apparatus and machines of chemical works are the fruits of the joint work of the Institute of Thermal Physics, the Siberian Affiliate of the Tekhenergokhimprom Scientific Production Association, the Energokhimmash Special Design Bureau, and the Institute of the Chemicalization of Agriculture of the Siberian Department of the All-Union Academy of Agricultural Sciences imeni V.I. Lenin.

Another long-established direction of our common activity with industry is the development of systems of the use of low-potential energy resources. The first developments of the institute were aimed at the use of geothermal sources of hot water for the generation of electric power by means of low-temperature freon turbines. The developments, which were aimed at the recovery of secondary energy resources and the low-temperature heat "waste" of industrial enterprises, were a natural continuation of this research. Means of recovering secondary energy resources for the generation of cold in large conditioners by means of absorption bromide-lithium refrigerating machines, electric power by means of freon turbogenerators, and thermal energy of the necessary conditions by means of turbotransformers and other devices were proposed at the Institute of Thermal Physics, the Energokhimmash Special Design Bureau, and the Siberian Affiliate of the Tekhenergokhimprom Scientific Production Association. Numerous industrial units for the use of secondary energy resources and the recovery of other waste products were developed at sectorial organizations which operate under the scientific supervision of the institute.

The purposeful science policy in the field of power engineering enabled the institute during 1984-1986 to take a most active part in the formulation of the subprogram "Energy Conservation at Chemical Works," which is being drawn up in accordance with an assignment of the State Committee for Science and Technology within the State Program for the Long-Range Future in the Area of Energy Conservation. The Institute of Thermal Physics, the Tekhenergokhimprom Scientific Production Association, and its Siberian affiliate cooperated in this work, which Academician S.S. Kutateladze supervised at the institute. According to estimates, the implementation of the basic stages of the subprogram will make it possible already during the 12th Five-Year Plan to save more than 10 million tons of standard fuel. Many problems here are connected with the intensification of the production of heat and mass exchange equipment in the sectors of chemical and power machine building. Many laboratories of the thermal physics departments of the institute are taking part in the development of the latest equipment of this sort.

The work on laser physics, which is being performed at our institute under the supervision of Corresponding Member of the USSR Academy of Sciences V.P. Chetobayev, in recent years has been formed into an autonomous scientific direction which is capable of becoming the nucleus of a special institute of laser physics of the Siberian Department of the USSR Academy of Sciences.

The basic research here is connected with the devising and development of methods of obtaining narrow optical resonances and with their use in spectroscopy of very high resolution and for the stabilization of the frequency of lasers. This research led to the emergence of fundamentally new directions of nonlinear spectroscopy. The proposed and implemented measures increased the resolution of optical spectroscopy by more than a millionfold. In 1978 the Lenin Prize was awarded for the work on nonlinear narrow resonances in optics, while in 1984 the C. Townes Prize of the American Optical Society was awarded for pioneering research in the field of laser metrology, spectroscopy of very high resolution, and highly stable laser sources.

These basic works were the basis for the first optical standard of time in the world, which was developed at the institute—optical hours, which make it possible to determine directly the unit of time—a second—by the number of periods of highly stable optical vibrations. The optical standard has an important advantage over the standards of the microwave band. It is possible by means of it to make time-and-frequency measurements with high precision (a relative error of 10^{-14}) over very short intervals of time (less than 1 second), which substantially broadens the sphere of application of the standard.

The equipment, which was developed when working on this important scientific and technical problem, was the basis for a number of instruments that were developed at the institute. Thus, the portable highly stable helium-neon laser with a methane absorbing cell on a wavelength of 3.39 micrometers with a width of the emission line of approximately 10 gigahertz and a long-term frequency stability of about 10^{-13} was awarded in 1979 a gold medal of the Exhibition of USSR National Economic Achievements. Such lasers are finding practical use in geophysics, seismology, medicine, machine building, and other fields. They constitute the basis of highly sensitive equipment for the measure of small strains of the earth's crust on large bases and the recording of seismic vibrations over a wide range of frequencies. This scientific direction is of consider national economic importance, contributing to the development of methods of the prediction of earthquakes and the prevention of the destruction of various man-made objects in case of the movement of rock bodies. Prototypes of laser strain gauges with a relative sensitivity of 10^{-9} on a base of 1-2 kilometers already exist. By means of them it was possible for the first time to record under the conditions of exposed atmosphere periodic displacements of the earth's crust on the order of 0.001 millimeters. The preparation of a unique experiment on the measurement of the relative strains of the shores of Lake Baykal on the section 40-50 kilometers long is being carried out. The laser gauge of small displacements on large distances, which was developed at the institute, at the spring 1986 Leipzig Trade Far was awarded a gold medal.

A heterodyne laser Doppler gauge of subsonic speeds (less than 10^{-6} meters a second) of motion of microobjects in flows of liquids and gases was developed. The possibility of using such an instrument in medicine for the rapid determination of the rate of sedimentation of erythrocytes in human blood was demonstrated. The first steps were taken in the development of medical equipment for the mass approximate analysis of blood in case of the prevention and early diagnosis of diseases.

Considerable attention at the institute is being devoted to such basic problems as measurements of transitions of the hydrogen atom, atomic interferometry, the radiation cooling of particles, and the detection of individual particles. For their solution it is necessary to develop adjustable lasers based on new active media. Among the adjustable lasers, which were developed at the institute, lasers based on the color centers in crystals, which are the most effective and practically the only radiation sources in the area of 0.8-3.5 micrometers, hold a special place. Owing to the significant contribution of the institute lasers based on stable color centers in lithium phosphide and sodium phosphide crystals, the synthesis of which has been assimilated by industry, were developed in our country. This work was commended by the Lenin Komsomol Prize.

Much work is being performed on the development of powerful reliable sources of laser radiation based on new active media for the purpose of their use in the national economy. A laser ophthamological device for eye microsurgery, on which successful operations have already been performed in a clinic, was apparently developed for the first time in the world on the basis of excimer lasers of the ultraviolet band (223 nanometers). The use of excimer lasers is also the basis for new methods of the precision working of materials, first of all dielectrics, with a micron and submicron spatial resolution. Such methods in specific cases can replace the now used multistage and hard to control processes of photoengraving.

Highly sensitive methods with a high spectral resolution of the diagnosis of atomic and molecular trace contaminants in gases and solids are being developed on the basis of the devised lasers. For example, the sensitivity of the new instruments for the detection of ammonia and ethylene in the air comes to approximately 10^{-9}, which provides a real basis for the solution of a number ecological problems. The successful accomplishment of the tasks of the identification of very small quantities of an impurity in source materials and the monitoring of the composition of atomic beams in the processes of vacuum evaporation of expitaxy (the growing of one single crystal on the surface of another—the base), which are of key importance in semiconductor technology, was demonstrated in experiments on the laser photoionization detection of atoms. The sensitivity of the method on real specimens comes to 10^{-11}.

The task of the acceleration of scientific and technical progress requires of the board of directors and public organizations of the institute the persistent search for new forms of work and the most effective means of using scientific achievements in the national economy.

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Mesyats on Ural Department of Academy of Sciences

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[Interview with Academician Gennadiy Andreyevich Mesyats, chairman of the Ural Department of the USSR Academy of Sciences, by SOTSIALISTICHESKAYA INDUSTRIYA special correspondent N. Ilinskaya: "The Reserves of Science of the Urals"; date, place, and occasion not given; first two paragraphs are SOTSIALISTICHESKAYA INDUSTRIYA introduction]

[Text] The Presidium of the USSR Academy of Sciences has adopted a decision on the organization of the Far Eastern and Ural Departments of the USSR Academy of Sciences. In order to become an active participant in restructuring, science itself in many respects should be restructured—this appeal to scientists was heard from the rostrum of the January CPSU Central Committee Plenum. The new regional subdivisions will create the conditions for the attainment by Soviet science of a level which will ensure the fulfillment of the tasks outlined by the 27th CPSU Congress.

In an interview with our special correspondent N. Ilinskaya Academician G. Mesyats, its chairman, tells about the prospects of development of the Ural Department of the USSR Academy of Sciences.

[Answer] The Urals are called the support position of the state. They govern in many respects the pace and proportions of the development of the economy. Practically all the most important sectors of the national economy are represented here. The contribution of the Urals to the economy of the country will also increase in the future. For this industry of the Urals has to be modernized and retooled. And in this great matter science has the first say.

In the decree on the establishment of our department it is simply recorded: to regard as the basic task of the Ural Department of the USSR Academy of Sciences the utmost development of basic and applied research, which is aimed at the solution of the most important scientific problems, as well as the accomplishment of tasks, which are oriented toward the acceleration of the pace of the economic and social development of the Ural Economic Region. Power engineering, electronics and information science, biotechnology, ecology, and the humanities are undergoing priority development.

[Question] Gennadiy Andreyevich, is science of the region ready for such a transformation, what is the level of scientists here?

[Answer] The Urals have highly skilled personnel. About 2,000 doctors and 20,000 candidates of sciences work here. At the institutions of the USSR Academy of Sciences there are 5 academicians and 16 corresponding members. The departmental breakdown of science is also interesting. In all 3.6 percent of the total number of scientists of the Urals work at academic organizations.

In all 25 percent of the scientists of the region are concentrated at 60 higher educational institutions. These are good prerequisites both for the training of the personnel we need and for joint work on scientific programs. The sectorial sector of science is 300 scientific research institutes and planning and design organizations, at which 49,000 scientists work.

So, as you see, the new department of the USSR Academy of Sciences is not a simple combination of academic subdivisions in the Urals. This is, in essence, the establishment of an integrated center which is capable of actually influencing the course of scientific and technical progress of the region.

[Question] Such a scale of tasks requires the efficient management of scientific activity. Today the term intensification should also be applied to science itself.

[Answer] We took precisely this into account when we decided to make the time-tested experience of the Siberian Department the basis of the management of science. The joint councils for the most important scientific directions will specify a unified science policy. Leading scientists of academic institutions, higher educational institutions, and sectorial scientific research institutes will be members of them. This principle will ensure the efficient management of the activity of various units of science and will attract scientists regardless of their departmental affiliation to direct participation in priority programs.

After all, what is work in accordance with unified scientific programs? It is the practical cooperation of institutes, which will automatically erect barriers to parallelism and a focus on petty topics. The scientific forces and resources of the Urals will be distributed more flexibly and dynamically, supplementing and strengthening each other. And then the new department will be able to deal effectively with the comprehensive development of the Ural Economic Region, the industrial potential of which needs retooling, while the raw material base needs new methods of assimilation and the commitment of the enormous resources of the North to use.

[Question] Does this mean that the largest balanced scientific production complex of the country has to be formed in the Urals?

[Answer] Of course. The formed organizational structure of the Ural Center is no longer ensuring the rapid development of basic and applied science. It formed under the conditions of the primarily extensive type of expanded reproduction. Therefore, in it the proportion of research that serves the raw material sectors is high. The earth sciences and metallurgy developed traditionally in the Urals.

Today science is called upon to ensure the priority development of machine building as the basis of scientific and technical progress. A start has been made—the Institute of Machine Science imeni A. Blagonravov of the USSR Academy of Sciences opened here its affiliate, which will become the transmitter of the achievements of the natural sciences in machine building of the Urals. The Institute of Electrophysics has been organized in Sverdlovsk for the development of fundamentally new machines and technologies.

We plan to give the status of institutes to the fruitfully working departments of physical technical problems of power engineering, selection, and the genetics of microorganisms. There is a program of the establishment of new institutes for the strengthening of the sciences of the biological, economic, and humanities types. A number of scientists made, in my opinion, an interesting suggestion—to return to the academy the Institute of Mining, which had been transferred to the USSR Ministry of Ferrous Metallurgy and turned into an appendage to the department. But it was established as a complex institute and could conduct research for ferrous and nonferrous metallurgy, geology, and the coal and chemical industries. Enormous stocks of production waste, which can in themselves serve as raw materials for metallurgy, chemistry, microbiology, and other sectors of industry, have accumulated in the Urals.

[Question] The establishment of the new department signifies both the broadening of rights and the increase of responsibility. At the General Assembly of the Academy of Sciences it was emphasized: one of the most important problems, which the Ural Department should solve, is the increase and acceleration of the practical return of science.

[Answer] The means for this are well known—the cooperation of forces, the organization of intersectorial interaction, and the development of a modern pilot experimental base of science. We have already spoken about the cooperation of forces.

I understand intersectorial interaction as follows: sectorial science should be a participant in and the guarantor of the advance of the achievements of basic research into production. Close interaction is a genuine reserve of science.

Good examples of cooperation exist in the Urals. Great possibilities are incorporated in the already established practice of concluding contracts with enterprises.

But then the material and technical base is frankly weak. A fourth of the equipment was acquired more than 10 years ago. We will establish modern testing grounds of science in the form of special design bureaus. The construction of the Special Design Bureau of Metallurgical and Chemical Technologies will begin in 1988. While for the time being, in order not to mark time, we will work at the pilot industrial bases of enterprises.

[Question] Will you not find yourselves there in the role of uninvited guests?

[Answer] On the contrary, we will be welcome. The State Committee for Science and Technology and the USSR Academy of Sciences by a joint decision laid the legal foundation of such cooperation. On our part we established in 1986 regional centers of the collective use of the unique equipment which academic institutes have.

We also see the point of the restructuring of regional academic science in the fact that even given a fixed number of scientists and resources new scientific results appear only due to organizational measures. We will work—actively, creatively, competently.

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Development, Introduction Of Rotary Equipment By Rotor Complex

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[Article by Academician L. Koshin, director of the Rotor Interbranch Scientific Technical Complex and Hero of Socialist Labor, under the rubric "Scientific and Technical Progress": "The Introduction of Rotary and Rotary Conveyor Lines in Production"; first paragraph is PLANOVOYE KHOZYAYSTVO introduction]

[Text] The advantages of rotary equipment. The organizational difficulties of introduction. The possibilities of the Rotor Interbranch Scientific Technical Complex. The prospects of the development of new models of rotary machines.

Rotary and rotary conveyor machines perform technological operations in the process of the combined movement of tools and objects of machining. They are the next class of machines which are taking the place of traditional production equipment. The need for the changeover to them is dictated by the fact that owing to their properties (the independence of performance from the duration of the operating cycle) they ensure high and identical performance in any operations. Therefore, rotary and rotary conveyor machines are being united into automatic lines, creating the possibility of the automatic maintenance of the tool in case of the continuous operation and maximum use of lines with a large number of combined operations. A sharp increase of the proportion of tools in the total weight of the machine and, consequently, a decrease of the cost of such equipment per unit of tools and performance are characteristic of them. As a result an abrupt increase of the main economic indicator—the social productivity of labor, that is, the total output per ruble of total expenditures, which is the basic goal of technical progress in production—is achieved.

The development of technological machines of this class for several elementary operations began in the late 1930's (initially in their rotary form and by the very small forces of one plant design bureau). In the early 1940's organizational decisions, which made it possible after the end of the Great Patriotic War to broaden the front of work significantly, were made. Several single-operation rotary machines for light press operations and the first models of rotary lines for assembly operations were developed and tested in operation. The fundamental advantages of this equipment with respect to performance, dimensions, and the suitability of its uniting into automatic lines were confirmed in practice.

However, the possibility of developing such machines for various more complex operations for the purpose of retooling works with them was considered impracticable for several years. The extensive introduction of rotary lines at sheet metal stamping works began in the 1950's. Heavy pressing operations, heat and chemical treatment, and various assembly, control, and measuring operations were also performed on rotary lines. At the same time the negative attitude toward this equipment remained. In particular, the opinion of its limited use only in the super mass production of small items, which have the form of bodies of rotation, was voiced. Therefore, the development of rotary lines continued to remain limited to a narrow departmental framework and was carried out almost exclusively at the Design Bureau of Automatic Lines (KBAL).

Only in the late 1960's did the experience of developing rotary lines begin to be used (as a local initiative) in several other areas of production. Several operating rotary lines were developed and introduced in the production of chemical sources of electric energy, plastic parts, several parts of agricultural machines, and others. These operations, which were performed by the small forces of plant design bureaus and repair shops, nevertheless yielded appreciable results. Among the most significant ones is the production of 14 lines for the molding of items made of glass-filled fiber at the Lyubertsy Plastics Plant, by means of which about 35 percent of the program of the plant is being fulfilled. Saratov State Bearing Plant No 3, using the basic technical solutions developed at the Design Bureau of Automatic Lines, designed and introduced a number of lines for the manufacture of needle bearings, reequipped production with them, and increased the output of products by fivefold, while having sharply reduced their labor-output ratio.

At the Voronezh Radiodetal Plant they performed an enormous amount of especially difficult, highly skilled work. Tens of types of rotary and rotary conveyor lines for the entire cycle of the production of electrolytic capacitors were developed by the forces of the plant design bureau made up of about 100 people. Here 1,400 workers were released with total expenditures of 3.6 million rubles.

These operations are of very great importance. They made it possible to completely modernize all the capacitor plants of the country. Moreover, many problems, which are connected with the complex operations that are used at works of sources of electric energy of batteries, resistors, and other electrical engineering items, were solved. An entire set of rotary lines, which were commended by the USSR State Prize, was developed for the production of bellows. The introduction of a number of efficient rotary lines at various works, it would seem, ensured the complete and stable changeover to this equipment wherever such work was performed. However, it carved its way with difficulty.

In recent years, when the party was formulating the strategy of the acceleration of social development on the basis of the achievements of science and technology, the extensive familiarization of specialists of industry and the staff of central departments with the experience of the development and use of rotary and rotary conveyor lines was organized. The obvious underestimation of the significance of this new and most important direction of the development of technology was noted.

Finally, in 1984 steps were specified for the extensive launching (on the basis of the use of the experience of the Design Bureau of Automatic Lines) of work on the development of such lines in all machine building sectors for the organization of their duplication and introduction in industry. But even after this the underestimation of rotary and rotary conveyor lines had an effect on the course of matters. It is characteristic that initially ministries planned assignments on the development and production of such equipment, which were at variance with the task of its mass dissemination. For example, the Ministry of the Machine Tool and Tool Building Industry planned to develop four lines during the five-year plan, the Ministry of the Electronics Industry—six.

During the consideration of the question in the Party Control Committee attached to the CPSU Central Committee in 1986 a principled evaluation of the proposals of ministries on the development of this equipment was given and the practice of delays was condemned. After this the state of affairs changed, the revision of the programs on the development and production of rotary and rotary conveyor lines began.

The Rotor Interbranch Scientific Technical Complex (MNTK) was established on the basis of the Design Bureau of Automatic Lines. An extremely important task was assigned to it—to expedite the transformation of rotary and rotary conveyor machines into the dominant form of technological equipment first of all in the production of discrete items.

In all 18 main organizations and enterprises of 16 ministries were appointed as participants in the work of the complex. Moreover, another four machine building

ministries were involved in the development of automatic rotary and rotary conveyor lines; their main organizations were specified. The management of the organizations and enterprises, which are participating in the work of the Rotor Interbranch Scientific Technical Complex, is carried out through the Council of the Complex, which was formed in accordance with the Model Statute on the Interbranch Scientific Technical Complex. Initially the volume of production of this equipment for the current five-year plan was established at 7,000 units, then the assignments were increased to 8,450 units.

During the 12th Five-Year Plan the total expenditures on the implementation of the all-union program will come to 1.09 billion rubles, including 234 million rubles for research and development and capital investments of 836 million rubles. As a result of the introduction of the lines produced in 1986-1990, 76,840 workers will be conditionally released, the economic impact will come to 409 million rubles.

The establishment in 1987-1989 of an intersectorial scientific information center with an educational design bureau in Klimovsk for the purpose of the training of engineers and the exchange of experience and scientific and technical information on the development of rotary lines is envisaged for the development of the production and educational base of the Rotor Interbranch Scientific Technical Complex. Moreover, the construction of educational design and laboratory production buildings for the Design Bureau of Automatic Lines is planned during the same period.

The implementation of a unified technology policy and the coordination of work in the area of the development, production, and introduction in the national economy of automatic rotary and rotary conveyor lines have been assigned to the Rotor Interbranch Scientific Technical Complex. Affiliates of the Design Bureau of Automatic Lines have been established for increasing the capacity of the complex. Now their specialization has been specified, it is proposed to assign to them the coordination of work among regions of the country. During 1988-1993 the construction of a pilot plant and an engineering laboratory building for the development and production of prototypes of standard lines is envisaged.

At present a number of steps, which are aimed at the creation of more extensive opportunities for the development of rotary and rotary conveyor lines, are being implemented. Design institutes are preparing designs of the construction of affiliates of the Design Bureau of Automatic Lines, for which sites are already being set aside. Temporary sites have been selected, are being prepared for transfer, or have already been transferred for nearly all the affiliates. The recruitment of design and technological personnel is under way. Orders are being placed for lines, which have been reequipped for new products which are produced in the corresponding regions. Work on the surveying of industry in the regions, where the affiliates are located, is being performed and plans of their provision with rotary equipment are being compiled.

How is it possible today to rate the practical steps? The increase of the number of created new models of lines, which have been developed and turned over to series production, have been introduced into operation, and have provided the planned increase of the social productivity of labor, should be considered the end result. Such a result does not yet exist, since much more time is necessary for it, inasmuch as the cycle of the development of a new model given the existing capacities of the organizations, which have been attracted to the Rotor Interbranch Scientific Technical Complex, will come to 3-4 years. For the present the result can consist in the increase of the number of design developments, at least their first stages—the technical assignments and designs. But they, too, have increased negligibly. In all 69 objects are at different stages of development (in addition to that which is being performed at the Design Bureau of Automatic Lines). This is obviously insufficient, if you bear in mind that it is necessary to develop approximately 1,500-2,000 types of operating rotary and mainly rotary conveyor lines. From them 100,000-200,000 lines, which replace 3-4 million operating machines and the same number of workplaces of manual labor and free 10-12 million workers, could be formed.

For the accomplishment of such a task 30,000-40,000 designers and process engineers are needed. At present only 2,000 people are engaged in this work.

An enormous number of specialists have to be retrained, the gained experience has to be conveyed to them. For the present about 200 people have undergone such training. The 2- and 3-month educational and on-the-job training courses at the interbranch scientific technical complex are training 25-30 specialists. There is nowhere to assign a larger number of them due to a shortage of housing and educational facilities. The interests of the matter require that 400-500 people would study simultaneously in such courses. The planned construction of an educational and on-the-job training center has not yet been started and will hardly be completed earlier than 1989. It is necessary to speed up the location of this center. The acceleration of the mass development of rotary equipment and the freeing of an enormous number of workers and production space depend on the settlement of this question.

It is also necessary to hurry with the training of personnel because the small contingent of specialists, who have the greatest experience, for age reasons may decrease sharply. It is insufficient to confine oneself to the education of personnel only at the Rotor Interbranch Scientific Technical Complex, since it is necessary to change the ratio between engineering and technical personnel, who have been trained in the traditional spirit, that is, who are oriented toward old equipment, and specialists, who are

called upon to solve new technical problems. At present chairs for robots and flexible machine systems have been established at many institutes, although such equipment very often is inefficient. At the same time chairs, which deal with the training of specialists in rotors, exist only at the Moscow Higher Technical School imeni N.E. Bauman and Tula Polytechnical Institute. This is obviously not enough, consequently, such a situation should be immediately changed.

For the acceleration of the development of new models of rotary conveyor lines it is extremely important to expand the capacities of the experimental base of organizations and first of all of those which are working successfully in this direction. Now even the largest organization—the Design Bureau of Automatic Lines—due to the small number of production workers produces the first model in 1.5-2 years. Meanwhile practical experience shows that it is possible to shorten greatly the process of production without detriment to the quality of design solutions by the enlistment of the capacities of series-producing plants in the output of parts of prototypes.

The shortening of this stage to 3-4 months would make it possible to allocate the necessary time for the trying out, testing, adjustment, and modification of the design. That is why a powerful experimental production base for the organizations, which develop rotary lines, is exceptionally important. It is advisable to keep the surplus capacities of design bureaus and institutes busy with the output of series lines. Here, as in the development of the base for the advanced training of design personnel at the Rotor Interbranch Scientific Technical Complex, one must not direct attention only to the construction of new facilities, inasmuch as it takes too long to accomplish.

It is necessary to change over boldly and resolutely the available capacities, and first of all those engaged in the production of inefficient equipment, to the manufacture of prototypes and the series output of rotary and rotary conveyor lines. The adequacy of the capacities will make it possible to accelerate the production of this equipment by the shortening of the stage of development and introduction. Such a possibility is connected with the production of not one prototype, but simultaneously of a small series (three to five models), of course, if there are no doubts about the fundamental correctness of the basic technological and technical solutions.

As experience showed, the increase of the number of models shortens the time of development and introduction, since design flaws are identified more rapidly, while their elimination is carried out on a broad front and with the enlistment of a larger number of active participants—assemblers, adjusters, testers. The additional expenditures on the modification of several prototypes as compared with one, as a rule, are recovered with interest as a result of the shortening of the time of the introduction of new equipment (of course, if economically it is highly efficient, which is characteristic of rotary lines). Therefore, it seems that economists should analyze the ratio between the expenditures and the economic impact subject to the production of one or several prototypes of new equipment. Moreover, it is necessary to develop methods of the calculation of their optimum numbers and to make adjustments in the formed practice of modifying new machines on one model.

An important direction of the work on the development of rotary and rotary conveyor lines consists in the pooling of the engineering, technical, and production resources of the CEMA member countries. In December 1985 the Design Bureau of Automatic Lines, on the basis of tentative information on the sectors of industry of the CEMA member countries, prepared a list of works, for which in accordance with their technological level it would be advisable to develop complexes of rotary conveyor lines. All the listed works are represented in the USSR, and, therefore, the development for them of new highly efficient equipment would also be useful for our country, where owing to various reasons the development of lines for such works will not be able to be priority development.

The subsequent stages of the work were considered obvious. It was necessary jointly with competent representatives of these countries to consider preliminary suggestions, preferably in the USSR, where there would be an opportunity to familiarize oneself thoroughly with operating lines and to identify their technical and, what is the most important thing, economic advantages. At the outside 10 days would be required for this. Further, the proposed list should be specified and priorities should be established in accordance with the criterion of the technological readiness of the works and the efficiency of their changeover to rotary and rotary conveyor lines. After this it would be necessary to acquaint the representatives of the Rotor Interbranch Scientific Technical Complex with the corresponding works in the CEMA member countries, to evaluate their technical level and degree of readiness for such a changeover, and to establish the amount of design and production expenditures of labor. This would make it possible to designate potential coperformers of the forthcoming work in each of the countries and to prepare the necessary agreements.

It would seem that it would already be possible to conclude agreements and to launch technological and design operations. However, the inadequate information of engineering and technical circles in the CEMA member countries are preventing this.

Many and not so much technical as organizational difficulties still stand in the way of the transformation of machines into the predominant type of equipment in the production of discrete items. But they will inevitably be overcome, a guarantee of which is the attention that the Central Committee of our party is devoting to this task.

7807

Training, Use of Engineers Severely Criticized

18140041 Moscow ZNANIYE-SILA in Russian No 6, 1987 pp 39-43

[Article by Professor Viktor Gertsevich Aynshteyn, doctor of technical sciences, Moscow Institute of Fine Chemical Technology imeni M.V. Lomonosov: "What Will Happen If Things Continue in This Way?—How Many Higher-School Graduates Do We Need? How Does One Solve the Problem of Quality of Their Training?"; first paragraph is ZNANIYE-SILA introduction]

[Text] "Raising the quality of specialists' training is the chief goal of higher school," is stated in "Basic Directions of Restructuring Higher and Secondary Specialized Education in the Country." The articles of Professor Viktor Gertsevich Aynshteyn of Moscow Institute of Fine Chemical Technology imeni M.V. Lomonosov in this and the following issue are devoted to an analysis of certain problems leading to the adoption of a number of decrees by the USSR CPSU Central Committee and the USSR Council of Ministers on higher school.

A comparison is usually made of the output of engineers in our country and in the United States. In 1950, 61,000 engineers were trained in the United States, in 1965—41,999 and during 1974-1975—57,000. In our country, the figures are, respectively: 37,000, 170,000 and 304,000. In 1980, we put out 350,000 engineers. The United States, however, stayed approximately at the same level. By 1985, the "production" of engineers in our country had stabilized, in the United States according to certain data, it had risen to 70,000. In addition, because of the "brain drain" Americans attract annually from other countries 3,000 to 5,000 specialists.

Of course, one must deal cautiously with this kind of comparisons. Principally because the actual concept of "engineer" is not identical for us and them. Let us say that among Americans a geological education produces a "geologist" and in the USSR a "geologist engineer." There are also other examples. It is likewise true that another consideration is significant: engineers in the USSR and the United States study comparable disciplines.... But, for example, an American geologist engineer has a narrower professional training than ours. Also the social aims of higher education in the USSR and the United States differ, so that there cannot be an equal number of engineers. But despite all the difference in the problems set by our and American higher school and the noncoincidence in the status of the engineer, the gap in the number of graduating engineers in the USSR and the United States is still too large.

We train per capita many more engineers than the developed socialist countries. At the same time, the sound proportion in the number of engineers and technicians has been violated in our country: in 1980, their ratio was 1:1.3, but 1:2 would be needed. It is like in the'60s when many VUZ's were open in our country (or the output of engineers in them was growing) without any relation to the needs of the national economy and primarily for the benefit of the ambitions of the local administration.

Such a "development," it would be more correct to say "inflation," of engineering education led to a number of negative consequences both for society and for higher school itself.

Overproduction of goods results in economic losses and overproduction—of specialists in social ones. Every trained engineer needs to be provided with an engineering job. And what if that is not provided and he is permitted (obliged) to engage in work not calling for the qualifications certified by the VUZ diploma? Then he loses his professional skill as an engineer, loses the desire to engage in engineering work and not only will stop making his contribution to the national economy but may even inflict a loss upon it. And not because the cost of his training will not be compensated (today 6,000-7,000 rubles). More significantly, he will not produce the expected return. It has been estimated that if a specialist is occupied 30 percent of the time in engineering work, then the state loses 300-500 rubles a year. And what if the share of time is larger? And what if not one but many? Then losses mount up to hundreds of millions and even billions of rubles.

Our engineers as a whole do engineering work. At enterprises and institutions, they are engaged in office work and "fill out papers." Once this got started, "improvement" of administrative personnel resulted in the curtailment of messengers and couriers. Now this work is performed by engineers. At scientific-research institutes and VUZ's they type out reports, work as fitters, laboratory workers. And the position of senior laboratory workers has become an engineering one , this time on "legal grounds." Engineers first of all, but perhaps secondarily after students are sent to do agricultural work, construction work and to vegetable facilities (you will encounter there candidates and even doctors of sciences), to cleaning streets.... In general, the work load of an engineer involving non-engineering work has become a customary matter and worse than that—habitual.

And the question arises: is it worth it to pay the salary due a real engineer for such work? Of course not, and the pay of an engineer usually drops relatively, it becomes lower than the average pay of a worker or employee in the country, and today this average wage (195 rubles a month) has practically reached even the pay of a candidate of science—a junior scientific associate with a length of service of more than 10 years (200 rubles a month). What will happen in general if more complex and skilled labor is paid less than more simple labor? Questions, questions....

And so low pay and even to a greater extent uninteresting (not characteristic of an engineer) work results in reduced authority of an engineering diploma and a drop in the prestige of the engineering profession. Engineers with a diploma leave their work and go on to other, more prestigious spheres of activity—even 10 years ago, there were more than one million such VUZ graduates. Many engineers, technicians even more so, work at workers' jobs. Five years ago, more than 2 million specialists with diplomas worked at workers' jobs. The billions of rubles spent on training these specialists have become dead capital. And we shall not cite unique workers' jobs where the knowledge of an engineer or technician is required. These cases do not make the weather. This is what overproduction of engineers is—the result of miscalculations in recruitment of personnel by ministries and departments, in inability (lack of desire?) of the top administration of higher school to safeguard their position. And when we warned of this danger more than 10 years ago, the USSR Ministry of Higher and Secondary Specialized Education stated that "an analysis of requisitions of ministries and departments indicates a constant need for engineers by sectors of the national economy." But the question of such requisitions was not raised. Reference was to their basis. However, ministries and departments find to their advantage the graduation of a large number of free (for them but not for society, of course) and low paid engineers: such can be used as they wish and where they wish ("wherever they are sent").

One cannot bypass the "iron-clad argument" of the partisans of retention of wide-scale output of engineers: in our country up to 20 percent of engineering positions are still occupied by practical workers without diplomas. Yes, occupied, and they do not do a bad job. And the reason they work, and not badly, is because these positions are by and large engineering in name only.

Regulation of engineering work is inevitable. But having yielded to inertia, we today do not seriously raise the question of reducing the output of engineers. Today in Moscow alone, 30,000 personnel in science and administration are being reduced. This is not a simple job, it involves the fates of people. But VUZ's continue to "cook up" specialists and in another 10 years, the situation could repeat itself.

Excess engineers also "weigh down" on higher school. Expanded admission to technical VUZ's has led to a sharp drop in competitive examinations. Whereas in the'50s, competitive examinations for submitted applications exceeded 5 persons per place, in the'80s, they have dropped below two. In 1984, the competitive examination for higher technical educational institutions in the RSFSR averaged 1.38, subsequently it has continued to fall. At the same time, a number of VUZ's, including some of the most prestigious, or their individual faculties, remained without competitive examinations. And VUZ's began to extend admission periods, to permit the reexamination of those with unsatisfactory marks (generally they did not risk having them take admission examinations) and to invite those who had not entered other VUZ's. Is it necessary to explain that expansion of admissions, especially under conditions of a demographic decline and subsequently forced lack of selectivity in the course of admission resulted in a serious lowering of the level of preparation of students and, most important, the bent for study and motivation.

But higher school then operated in a regime of self-justification. It wanted to show that everything was in order. The remarkable directive of the People's Commissariat of Education toward the end of the'20s was consigned to oblivion (higher school was at that time subordinated to it). It prescribed that "...no exaggerated figures of students' progress and figures for show are to be cited and poorly prepared students under no conditions are to be advanced to the next courses. Let this outwardly mean a reduction in the percentage of those passed from course to course. Actually it means growth in the progress of students, strengthening of the operation of higher school and increased demands on itself."

And so normative documents were created, seemingly stimulating lowering quality of training (the concomitant strain on the moral climate in VUZ's apparently did not interest the top administration). First among them was the introduction of a permanent coefficient for the number of students, the staff size of instructors being rigidly tied to the number of students. With a coefficient of 10.6 for the country, this meant that the dismissal rate had to be artificially maintained at a constant level regardless of the quality of specialist training. After all, an additional expulsion of 11 students meant firing an instructor. As a result, the strongest pressure on instructors came into being from the administration of VUZ's. Certain ways of thinking and operation appeared and were bolstered with the support and pressure of finance organs in evaluating students' knowledge: "we write down a passing grade while holding the failing grade in one's head."

The students, getting the feel of the situation, began to study more poorly and instructors for the purpose of retaining the number of students (which meant the staff size of instructors) lowered requirements. Thus the teaching process was transformed into an unstable system with a positive feedback. Large gaps in prior knowledge appeared among the students, as we stated, and this was a very strong demotivator in study.

The dropout rate of students, on being regulated, started to influence the quality of specialist training. It is indicative that in 1960 it amounted to 6 percent, in 1970—to 14 percent, but in 1980 it was reduced to 10 percent. If one thinks about it, it attests to a drop in the quality of study. But at that time the USSR Ministry of Higher and Secondary Specialized Education and the press lauded educational institutions that operated over the course of many years with practically no dropouts or those where a significant portion of student groups passed an examination session without unsatisfactory marks. They even

began to count up the percentage of passing grades, proclaiming it excessive for individual groups and disciplines. But the fact that departure from engineers on completion of an institute was also dropping out (by the most conservative estimates on the level of 20 percent) was simply ignored. Also ignored was the fact that at the VUZ they vegetated. More often they did not want to study, less often they could not, while many of the so-called "students" managed to advance from one course to another. Which of them are engineers, physicians or teachers? (I stress: the Decree of the CPSU Central Committee and the USSR Council of Ministers on Higher School abolishes the dependence of staffs of instructors on the dropout rate of students).

And here is the result. The instructors of a VUZ found themselves in an ambiguous position when, regardless of performance, they were rebuked for being demanding toward students, while for not being demanding—a precondition of defective work—they were praised. Even experienced instructors began to get used to not making demands, while the young ones were penetrated by the conviction that this is the normal way of operations, and the VUZ instructor experienced degradation, both professional and moral. But absence of demands constitutes a soil for law violations: when it comes to bribes, higher school occupies far from last place! And what is even more frightening—protectionism on entering VUZ's, in taking examinations, in allocation. We must grapple seriously with this widespread phenomenon.

But something else is much worse: the instructor found himself engaged first of all in bringing up laggers to an acceptable level. But capable ones and those desiring to study he fails to provide with knowledge, skills and emotions. This is how leveling of specialists occurs, and a shortage of knowledge, desire and responsibility arises. In recent years, the responsibility for study, public work, behavior beyond the confines of the VUZ has been practically removed from students and placed entirely on instructors and specially selected persons—observers frequently playing the role of "boys to be beaten." Are not these, if they may be called that, the higher-school "pupils" of the'70s who after a couple of decades will find themselves directly or indirectly guilty of faulty ecological and economic decisions—Baykal and Ladoga, the Aral Sea and Sevan, of sea and railroad catastrophes and of accidents in mines?

All the deficiencies in the training of specialists have been to the highest degree characteristic of the evening and correspondence forms of education, The quality of training here is extremely low. Of course, it is socially unjustifiable to deprive production workers of the possibilities of obtaining a higher education. But it must not be a second-class education. Originally, it was intended to provide such an education to practical workers acquainted with engineering problems in the course of their work but not possessing systematic knowledge, and the higher technical educational institution would put this knowledge into a system. But today people almost always study at evening and correspondence divisions without practical skills and without having encountered engineering problems. For the most part they simply have not gone through the day form of education. Having at their disposal one-half to one-third less in the way of resources of time and not at all better training, they as a rule cannot take in the full scope of engineering knowledge, although they satisfactorily obtain a full-pledged diploma. Especially for this reason, non-independent performance of homework assignments has become widely prevalent at evening and correspondence higher school (a special business has come into existence taking advantage of this demand and the wide-scale use of cribs (for the sake of fairness, we will note that day school is also infected with them). You yourself can understand the help from such "specialists" after graduation from a VUZ.... Incidentally, in the United States, evening education by 1980 provided 7 percent of engineers, in our country, more than half of their output comes from evening and correspondence-school students.

There are many other problems in the training of specialists. The apparent "free nature" of the training of engineers is due to lack of attention to the needs of higher school on the part of users of specialists and local governing organs. Students are deflected to different noneducational work with surprising ease. VUZ's with rare exceptions experience a shortage of funds. It is no accident that the decree on higher school provides for partial compensation of costs going into the training of specialists by ministries and departments.

It is possible and necessary to speak of many things, but there must be a limit somewhere....

7697

Construction Delays for Information Center

18140165 Moscow STROITELNAYA GAZETA in Russian 27 Nov 87 p 2

[Article by D. Dubel, electronics engineer, information-computer center for collective use; and P. Serebryakov, chief, Department for the Management of Scientific-technical Information and Propaganda, USSR GKNT [State Committee for Science and Technology]: "When Responsibility is Lacking"]

[Text] It was back in 1983 that the Moscow Trust, Mosstroy-14 of Glavmosstroy began construction work on the production-laboratory building for the Scientific-technical Information Center (VNTITsentra) in Moscow. Because of continual idle time and late deliveries of cement and concrete, the builders could not support the installation work of the SU-117 trust Mosprommontazh [Moscow Industrial Installation], Glavmosmontazhspetsstroy [Main Moscow Installation and Special Construction Administration].

Because of the poor organization only 20 percent of the 4.02 million ruble construction-installation work plan was completed. The construction site is now totally frozen.

Project maintenance costs for work to be completed in 1987 are 400,000 rubles. However, because of poor organization workers and machinery still sit idle. As of 1 October only 10 percent of the work had been completed. Once again, construction is delayed and money lost.

This production-laboratory building is important to scientific and technical progress. It will house powerful fourth generation multiprocessor computer systems, making it possible to improve the standards and quality of information support to the country's enterprises and organizations.

This project has now reached a dead end because, in violation of the law, the general contractor accepted a 1988 contract plan totalling only 500,000 rubles, instead of the 1.4 million called for by the construction organization's draft plan. For this reason the USSR Promstroybank [Industrial Construction Bank] is once again, just like in 1987, not approving the project's financing.

Repeated requests for help from Mosgorispolkom, the CPSU Moscow City Committee, the GlavUKS at Mosgorispolkom and Glavmosstroy have not yielded positive results. It is therefore useless to send this letter to these organizations.

Recently we have been justifiably talking about the need to introduce a new economic management mechanism. Sometimes, however, it is not innovations which are needed, but a responsible attitude towards the matter at hand. This, obviously, has not been shown by the Mosstroy-14 Trust during restructuring.

11574

New Graphic Programming Technology Developed

18140000a Moscow NTR: PROBLEMY I RESHENIYA in Russian No 13, 7-20 Jul 87 pp 4-5

[Interview with Doctor of Physical Mathematical Sciences Professor Igor Vyacheslavovich Velbitskiy, head of the Programming Technology Department of the Institute of Cybernetics imeni V.M. Glushkov of the UkSSR Academy of Sciences, director of the Intersectorial Center of Programming Technology, and winner of the UkSSR State Prize, by A. Kuznetsov: "Get Acquainted With R-Technology;" place, date, and occasion not specified; first paragraph is NTR: PROBLEMY I RESHENIYA introduction]

[Text] doctor of Physical Mathematical Sciences Professor I. Velbitskiy, head of the Programming Technology Department of the Institute of Cybernetics imeni V.M. Glushkov of the UkSSR Academy of Sciences, director of the Intersectorial Center of Programming Technology, and winner of the UkSSR State Prize, presents the new graphic programming technology.

[Question] Starting in approximately the middle of the 1960's the cost of computer hardware drew level with the expenditures on programming, but starting in the middle of the 1970's the expenditures on programming began to grow sharply. If nothing is done, during the 1990's the ratio between the price of programs and hardware will be the same as between the cost of a commodity and its packaging. That is, the computer will become the "packaging" for the commodity—the program.

[Answer] Let us examine what a program is and why the cost of its production is growing so sharply. A program is a certain list of commands (orders to a computer), which are recorded in the external memory of a computer on a magnetic disk or a cassette, which resembles an ordinary tape cassette. Why does what is recorded on such a cassette cost more than the cassette, tape recorder, and the entire computer?

Generally speaking, the answer is simple: the labor of a programmer is very specific and complex. In your opinion, how many commands can a programmer develop in a day?

[Question] I do not presume to say exactly, although I myself had occasion to write programs. Apparently, no more than 50 to 100 per day?

[Answer] In my question I especially singled out the word "develop." Not write or print, but precisely develop, construct, because at first it is necessary to investigate a problem, to analyze it, to devise an algorithm for solving it and a method of realizing it on the computer, to record an algorithm in the form of computer commands, to feed them into the computer, and then to debug them, that is, to become convinced that the

program and the computer do precisely what is required under the condition of the problem. Finally, it is necessary to account for everything—to describe the algorithm and the program corresponding to it, to prepare instructions on how to use all this, to deliver the job to the client, and so on.

If we talk about the number of commands in a program, the algorithm of whose solution is known, in fact, a good programmer can write 100 and even more of them a day. However, if we calculate the number of commands in the program, which the programmer developed as a result of all the work on it—from the formulation of the problem to its delivery to the client—and divide them by the number of days which he spent on this, the productivity of his labor—the number of commands a day—will be much smaller. Thus, ubiquitous statistics indicate that the average professional programmer can develop 8-10 commands a day, while for real-time problems (the control of real systems, for example, an aircraft or a technological process, during their operation) even less—only 2-3 commands. This figure is average, but, what is especially remarkable, it has lasted for more than 10 years. Although the generation of programmers has been replaced during this time, the pool of computers and means of automation of programming has been completely updated. Such a constancy, such a low labor productivity in a sector, which is now developing more rapidly than aircraft building or television, may indeed seem strange.

There are many reasons for this. First, the human brain is not adapted to thinking in a determined and strict manner like a computer. Second, everywhere, in any sector of industry, with which man has been accustomed to deal to this day, there are "allowances and fits"—permissible deviations from ideally accurate dimensions. In programming there are and can be no such allowances. The apparent simplicity of computer commands and the simple and natural, at first glance, method of recording them are very confusing. But just as harmless snowflakes form a threatening avalanche, so programming difficulties increase like an avalanche in case of a large number of very simple commands.

In part these difficulties are being overcome today by means of automation equipment, which is based on computers themselves. So-called algorithmic languages, or programming languages—from Macroassembler and FORTRAN to ADA—form their basis.

At first it seemed that there would be few such languages—one or two: FORTRAN (1955) for computer problems and COBOL (1960) for economic problems. Very soon, however, it became clear that almost as many machine languages as there are areas of application of computer technology are needed. Therefore, right now there are about 2,000 (!) programming languages. And this is after only 40 years of development! For comparison: the number of natural languages on earth is now also close to 2,000.

The experience of developing programs during the past 20 years, when the entire modern arsenal of means of automating programming was born, showed the low efficiency of organization of this process. Now, as 20 years ago, programs are developed primitively and slowly, their quality is low, the time of efficient operation is extremely short, the coefficient of reuse of programs is intolerably low, standardization is absent, the duplication of developments is very widespread.... As a result the cost of programs is growing constantly and the demand for them is not being met and is not backed by the existing means of their production.

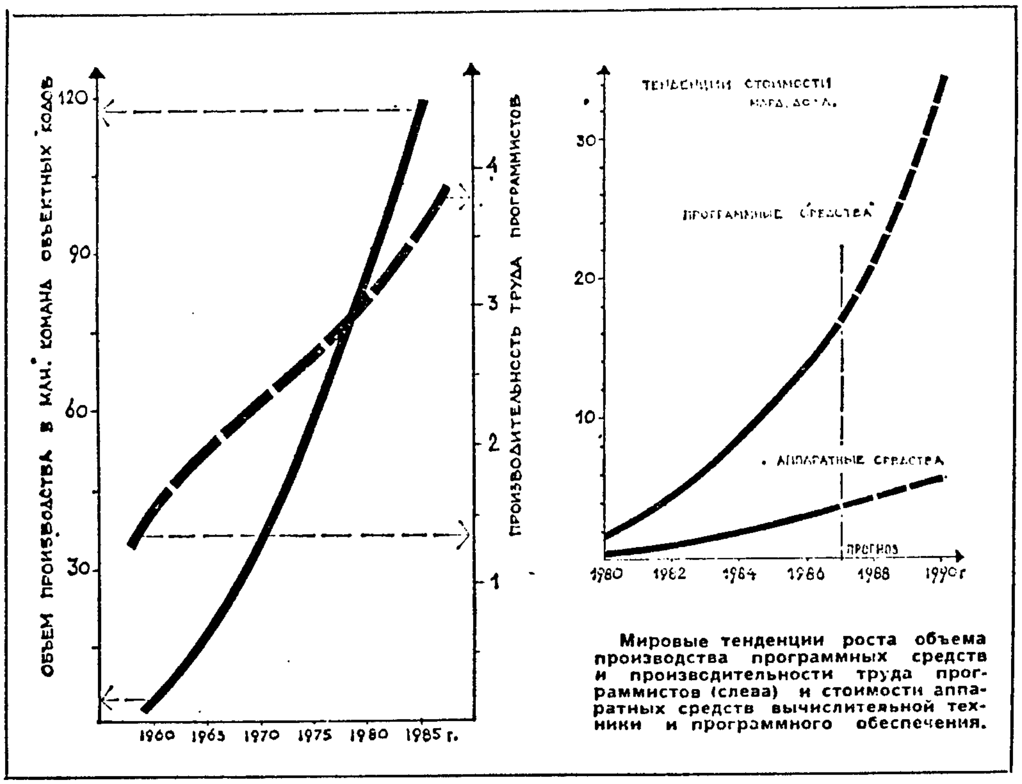
To meet the strategic need for programs and to eliminate the formed situation we have set for ourselves the task of the industrial organization of the process of developing programs, moreover, in the intellectual, not the material, sphere of human activity, which programming is. It was necessary to optimize the creative process from the formulation of an algorithm to the acceptance of a program by the client and to create a new level of programming culture, and not merely to increase the automation of the art of individual program development.

Whereas in case of the designing of traditional industrial articles only a design, which later is repeatedly refined and improved at the stage of production of a prototype and an experimental batch, the technological preparation of production, and so forth, is obtained as a result, in programming as a result of designing a finished item—a program—should be obtained immediately. There are no subsequent stages of refinement and improvement, at least in existing programming there are not. This idea is important for understanding the initial cause of many difficulties in programming.

Next, the industrial technology of developing programs should be intended not for selected programming intellectuals, but for a wide range of specialists, and not just programmers who are united by joint creative activity. The problem is complicated by the fact that the program as an industrial article is distinguished by an exceptional logical complexity and depth within a very simple, even elementary form.

[Question] Igor Vyacheslavovich, you talk about programming as a technology. If technology in general is discussed, this is none other than a combination of methods and means of production. It seems to me that such a concept as "art" is associated rather with the word "programming."

[Answer] There is no contradiction here. Simply life, the demands of practice, and the need for computer hardware that is equal to the problems force us to search for ways of creating an industrial standard (principles) of program development. By another way—by the spontaneously developing creativity of people working on their



Мировые тенденции роста объема производства программных средств и производительности труда программистов (слева) и стоимости аппаратных средств вычислительной техники и программного обеспечения.

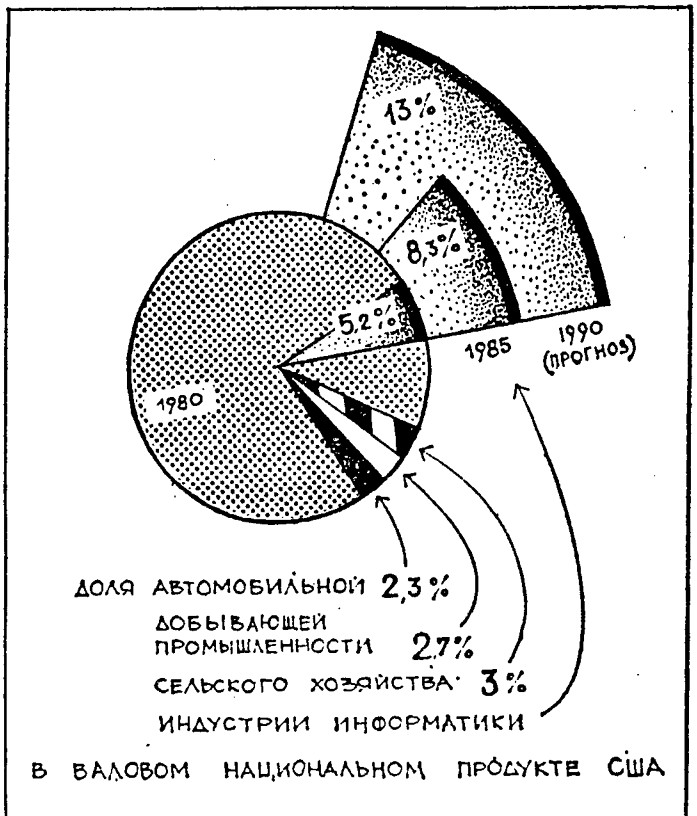
Key:
1. Production volume in million of commands of object codes
2. Labor productivity of programmers
3. Cost trends, billion of dollars
4. Programs
5. Hardware
6. Forecast

own (or, as they are still called, chief programmers)—this complex problem cannot be solved, and the practice of the last 20 years shows this convincingly.

The industrial standard under discussion is primarily a technology in a nontraditional creative sphere of the activity of man—in the process of designing and creating something new—in this case programs. Such a technology includes all stages and steps of the creative process of development of algorithms and their models, not only of programs. It contains not merely the list of possible technological operations and standards, but also the recommended order of their execution, documentation, and control, which block it against typical errors of an "unprincipled" or unorganized programming process. Such a technology will make it possible to ensure the detachment of programs from developers and their interchangeability in the process of work, will make it possible to easily interface independently developed programs, and will ensure new principles of their funding and a repeated applicability. This will make it possible to change over from the existing situation, in which it is easier to write the program anew than to understand it, to a fundamentally different situation, in which it will be easier to assemble a program from ready-made components than to develop it anew.

[Question] Thus, we have arrived at the concept of programming technology. Since it is clear that the formulation of such a unified approach is necessary for the further development of programming, the question arises why was this not done earlier.

[Answer] The first works on programming technology began to appear about 20 years ago after the publication in 1968 of an article by E. Dijkstra, a theoretician and founder of most foreign technological systems. This small article served as the beginning of an entire era in



Share of the Information Science Industry in the U.S. Gross National Product (1980,1985, and 1990 [estimate])

Key:

1. Forecast
2. Share of the automotive industry
3. Of the extractive industry
4. Of agriculture
5. Of the information science industry
6. In the U.S. gross national product

programming, which was called structured programming. Its essence lies in the fact that a certain structured statement standardization of procedure-oriented languages is proposed. The number of language statements is reduced to three or four, a standard form of representation—one input and one output—and a standard use circuit—series connection and nesting—are assigned to each statement.

Such seemingly simple constraints on the number, form, and method of use of statements made it possible to fundamentally streamline the entire programming process, which, in turn, made it possible to streamline the process of debugging and maintaining (making changes in the process of use) of programs. For the first time the opportunity appeared to devise a technology of the design development of programs, which does not depend on the class of problems being solved—be it engineering and economic problems, problems of real-time control, automated control systems, computer-aided design systems, and so forth.

[Question] That is, in principle, structured programming has solved all the problems?

[Answer] That is not entirely the case. Practice has shown that structured programming is being introduced very slowly and the effect from it does not meet the expectations. There are two reasons for this. First, the principles of structured programming, which was proposed by Dijkstra, are of an empirical, indistinct nature—thee is no mathematical orderliness.

Second, structure is a multidimensional concept. Therefore, the representation of this concept by means of linear texts (a sequence of statements) virtually nullifies the advantages of the structured approach. The vast associative capabilities of the visual and intellectual mechanisms of man are virtually idle—for recognizing structured patterns in the form of a uniform sequence of symbols.

[Question] A deadlock seems to be appearing. Does what you said mean that all the reserves of the significant increase of labor productivity in programming have been exhausted?

[Answer] Such a conclusion would be incorrect. It would be more correct to say that the reserves of the increase of productivity will be exhausted, if we remain on the path of a textual representation of programs, as was the case until recently. This path is based on the concept of programming language. As I have already said, the alphanumeric representation of information, although simple and reliable in implementation, is not clear, is not compact, and does not make it possible to fully use the most powerful intellectual mechanism—the mechanism of visual association. Imagine for a second that, instead of drawings, in the modern industry there will be texts describing them.... Another path developed in our country since 1970 is based on a change in the basis for programming—the introduction into programming of graphic visual images, graphs, and drawings, in much the same way as is done in any industrial sector. Man resorts precisely to a drawing, to visual professional symbolism, whenever he must solve a truly complex problem.

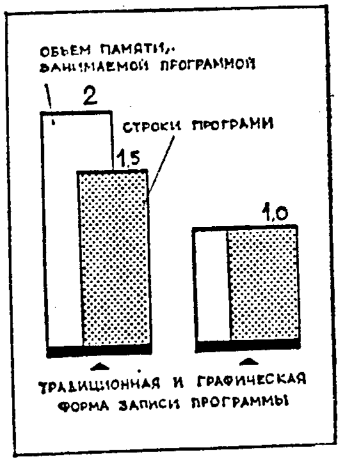
The idea of this path is simple and natural. It is proposed to use for the presentation of information figures, schemes, tables, diagrams, pictograms, and so forth, moreover, not only for the auxiliary work of man outside the computer, but also for the input/output of information into the computer and for the designation of the program of its operation.

The use of the graphic style in programming makes it possible to approach the solution of all problems without exception in a new way. Incidentally, the Americans have also reached a similar conclusion. In the journal COMPUTER, No 8, 1985, which is entirely devoted to graphic, or visual, programming and in which articles by specialists from the United States, Japan, England, Norway, and so forth are collected, graphic programming is spoken about as the only way out of the deadlock.

[Question] As one of the authors of the fundamentally new graphic technology developed at the Institute of Cybernetics imeni V.M. Glushkov of the Ukrainian SSR Academy of Sciences, please describe the technology itself.

[Answer] Indeed, we in close cooperation with the machine building sectors of industry and specialists from Moscow, Leningrad, Kharkov, and other cities of the country succeeded in developing and introducing into practice a fundamentally new graphic paperless programming technology. We named it Russian technology, or R-technology.

The R-technology of programming is intended for the development of a broad class of programs, including structurally and logically complex software in all areas of application of computer technology.



Ratio of the Number of Lines of a Program and Volume of Memory Occupied by It With Traditional Linear Recording and Recording by Means of R-Schemes

Key:
1. [illegible]
2. Program lines
3. Traditional and graphic forms of program recording

The basic principle of R-technology lies in the fact that, in contrast to the traditional approach, it is proposed not to write, but to draw programs. To draw them in the language of arc-loaded oriented graphs....

[Question] Before engaging in a further description, let us recall what graphs are.

[Answer] The flowchart, or, as it is still called, the "node-loaded graph," is the most widespread figure in programming. However, such a form of recording has two significant shortcomings. First, it cannot be used as a program for direct input into the computer and, second, recording by means of such graphs, although graphic, is not compact. It is inconvenient to reproduce it in input/output devices—displays and alphanumeric printers. Such recording loses significantly in the compactness of the recording of programs in traditional algorithmic languages. The technology, in which two character systems—graphic (at the stage of precomputer designing) and traditional linear for the input of a program into a computer—are used, is complex and inefficient. Therefore, node-loaded graphs are used in programming only in exceptional cases for especially critical designs as a means of the manual designing and documentation of programs.

There is another method of graph representation—what is called "arc-loaded graphs"—which can be exemplified by network schedules. Thus, precisely arc-loaded graphs are used for program recording in R-technology. R-schemes, which are not inferior in their clarity to flowcharts, are more compact (in terms of alphanumeric representation on the average three- to fourfold). Moreover, it is simpler to realize R-schemes, which have only horizontal and vertical lines, in input/output devices of

computers. The chief thing lies in the fact that such a representation of R-schemes provides a universal method of expanding them and makes it possible to design complex R-schemes from simpler elements. Finally, this makes it possible to introduce into programming the concept of drawing and the discipline of drawing management connected with it, which are well developed in production practice.

Thus, the program in R-technology represents an arc-loaded graph. The condition of movement along the arc is recorded above the graph arc and the operation (the sequence of assignment statements or procedures), which is performed if the corresponding condition is true, is recorded below.

R-technology is based on the algebra of program design. Like any algebra, it is defined by a set of elements and a set of permissible operations on them. Two graphic structures, on which three operations—series, parallel, and nested connection—are determined, are used as elements of R-schemes. Thus, a program of any complexity is formed and assembled from two elementary "small bricks" by means of the repeated execution of these operations, like an architectural structure made of building blocks.

Together with graphic representation in R-technology we arrive at another important concept—technological language. In contrast to traditional algorithmic languages, the technological language is a certain sufficiently free language of formulation of texts, logical statements, thoughts, specifications of program designs, formal records of algorithms, and programs with a gradual multilevel refinement of all the designations used in them and with a description of the organization of the work of the collective, performers, and so forth. In some sense the technological language is the language of professional prose and a lexicon, in which any informal designations are systematically detailed by more accurate and strict definitions. Thus, programming in a technological language is programming in the natural national language in a graphic form with the utilization of arbitrary professional designations, which are most natural and convenient for man at every step of program formalization. Not designations, but the relations between them are programmed.

Traditional programming languages, such widespread ones as FORTRAN, PASCAL, and so forth, serve in R-technology only as a "filler" of a corresponding technological "shell" at the stage of coding of fragments of algorithms for computer operation.

The graphic apparatus of R-technology is formulated in All-Union State Standard 19.005-85 "The Unified System of Software Documentation. R-Schemes of Algorithms and Programs. Standard Graphic Designations and Rules of Execution." I can say that this standard does not have prototypes and foreign analogs. For work on R-technology at the Institute of Cybernetics imeni V.M. Glushkov of the UkSSR Academy of

Use of Information for Technical Development

18140109 Moscow EKONOMICHESKAYA GAZETA in Russian No 45, Nov 87 p 9

[Article by Candidate of Economic Sciences M. Karpunin under the rubric "Scientific and Technical Progress: Economics and Management": "Information Is an Economic Resource"; first paragraph is *Ekonomicheskaya Gazeta* introduction]

[Text] Ideas about the new role of information services in the present process of technical development were advanced in the article of USSR Deputy Minister of the Electrical Equipment Industry Yu. Nikitin (No 42). Today we are continuing the discussion of the role of the information unit in the development of the economy.

The attainment of new levels in the economic area presumes the raising of the national economy to a fundamentally new scientific, technical, and economic organizational level, its changeover to the path of intensive development, and the achievement of the highest world level of the productivity of national labor, product quality, and production efficiency.

Social progress today is being ensured in many respects by the active search for new, more productive knowledge and by the high speed of its materialization. Under the conditions of the present scientific and technical revolution the pace of the gaining of knowledge of the objective laws of the development of the material world has increased substantially, new types of energy are being discovered, and new substances and construction materials are being developed. It is well known that any object of the application of human activity, be it an item, a technology, or a production process, has its own limit of development, its own limit of economic efficiency. Therefore, it is not enough to predict and establish the exact time of the exhaustion of the possibilities of growth of the potential return of existing material and organizational structures. It is important to find in good time effective alternatives to previous decisions and with allowance made for this to make the practical use of new knowledge a component of the organization of economic activity and an integral part of the economic process.

But There Is No Demand....

In the report at the June CPSU Central Committee Plenum M.S. Gorbachev noted: "...the concept of the restructuring of management has as its goal...to transform scientific and technical progress into the main factor of economic growth and to create a reliably working anti-expenditure mechanism."

Today information is becoming one of the key units of scientific and technical progress. In the country there are more than 200 all-union, territorial, and sectorial organizations of scientific and technical progress. It is, it would seem, a colossal force. However, everything becomes known in comparison. According to the testimony of the journal *SShA—Ekonomika, Politika, Ideologiya*, in the United States in recent times the number of national databases, which on a commercial basis make information in electronic form available to their clients, has been increasing rapidly. Whereas in 1979 there were 400 of them, in 1986 there were already 2,800. This comparison forces one to ponder.

However, the potential of information science, which exists in our country, today is also passive. The established system of scientific and technical information is not fully performing even the educational functions with respect to scientists and engineering and technical personnel, not to mention the organization of research and the dissemination and the expansion of the use of advanced know-how and effective scientific and technical solutions. What are the main shortcomings of this system? In the estimation of specialists, these are the inability to make available to developers information, which is ready for immediate use, and the lack of information resources. It is a matter, in my opinion, not only of the poor organization of the system of information. The necessary demandingness and readiness of those, for whom this information is intended, and the inadequacy of their information culture do not stimulate the development of information science. Here we have a case, when the lack of demand does not give rise to supply.

Economists are also to blame for this. Despite numerous attempts, we have not been able to develop an effective economic mechanism, which would make the constant updating of production on the basis of advanced achievements of science and technology a requirement of everyday economic activity. All this has checked the formation of a fundamentally new system of relations between the users and processors of technical and economic information and has postponed the establishment and functioning of a modern system of information supply.

The Three "Whales" of Updating

Let us turn to the three components of the process of updating production: the development of a new product, the improvement of technology, and the rationalization of labor processes. The enforceable documents, which regulate the system of the certification and technical and economic evaluation of a product, technological processes, and workplaces and the determination of the organizational and technical level of production as a whole, direct specialists to the mandatory use of the corresponding information.

Thus, the prevailing procedure of the certification of an industrial product by quality categories envisages the analysis of the best world and domestic models of equipment and the gathering, processing, and systematization of data on the use of the product for the purpose of determining the stability of its properties. In case of the certification of technological processes with the aid of the information base of the all-union data bank on technological processes it is necessary to identify interconnected and competing processes and to estimate the efficiency of the technologies, which are being proposed for use, and their influence on the economic indicators of production. For the purposes of the certification, rationalization, registration, and planning of workplaces it is necessary to take into account the information on advanced domestic and foreign know-how, the requirements of all-union state standards, sanitary and construction norms and regulations, intersectorial and sectorial standards on labor, type plans of the organization of labor at the workplace, and other information. In case of the certification of a significant number of identical or similar workplaces it is proposed to create reference workplaces with advanced equipment and technology and conducive and safe working conditions, which are irreproachably maintained by personnel of such a skill, which would make it possible to ensure the required level of the labor intensiveness and quality of work. For this it is also necessary to enlist information which is most diverse in its content. A similar approach is also contained in the Procedural Recommendations on the Evaluation of the Organizational and Technical Level of Production, which were approved by the USSR State Committee for Standards in 1985.

In Form and in Essence

However, the careful analysis of the named enforceable documents convinces us that an interested attitude toward the use of the most objective information is present in them more in form than in content. In the corresponding appendices on information there are no indications of the technology of "obtaining" and processing the required information, while in a number of cases the members of certification commissions are referred to such sources, most often to the forms of official statistical reporting, in which the data necessary for objective evaluations are simply lacking. Experienced workers are also not exerting in any way appreciable efforts to correct the formed situation. And the reasons here should be sought not only in the imperfection of the economic mechanism. They also lie in the low level of the standards of work of the majority of specialists. For many of them the handling of the latest information on achievements of science and technology in the sphere of activity, which has been chosen by them, has not become an integral component of the organization of their labor. In confirmation of this it is possible to cite the following example. In late 1985 a system of the intrasectorial exchange of information on introduced scientific and technical achievements, the goal of which was the broadening of the scale of the economically

advisable reuse within the sector of innovations, which had been introduced in the production process at individual enterprises, was put into commercial operation with the participation of the author in the Ministry of the Electrical Equipment Industry.

A set of documents, which specifies the thematic range, the organizational functional structure, the means of implementation, and the technology of the functioning of the system, was drawn up by specialists of the All-Union Scientific Research Institute of Information and Technical and Economic Research in Electrical Engineering, the main institute for information science. Suggestions on the material stimulation of work for the development and entry of information on scientific and technical achievements and its use were prepared. According to estimates, when the system reaches the rated capacity, the exchange of such information should increase from the 400-500 information cards, which previously circulated in the sector, to 4,000-5,000. Here the total economic impact from the repeated introduction of scientific and technical achievements will come to 12-15 million rubles.

What is the rate of dissemination of this "low-expenditure" and practically tested method of deriving an additional economic gain? In 1986 information cards on 1,400 innovations, of which 950 were recommended for reuse within the sector and 450 were recommended for reuse within subsectors, were received from enterprises and scientific organizations. For the 1st year of introduction 1,400 cards, 7,500 copies of which went to potential users, perhaps, are also not that few. However, during this period only 8 return control tickets for the reuse of documentation were received with an economic impact of 150,000 rubles. And this is at a time, when approximately a fifth of the assignments on the saving of material resources, and first of all rolled metal products, which had been delivered to the USSR Ministry of the Electrical Equipment Industry for the 12th Five-Year Plan, had still not been confirmed by the elaboration of specific measures.

Urgent Tasks

Such a wasteful and, at times, also irresponsible attitude toward the use of information, which is called upon to be a factor of a creative economy, is not a rarity and not a regrettable exception. Let us recall that in the decree of the CPSU Central Committee and the USSR Council of Ministers "On Measures on the Radical Increase of Product Quality" (1986) it is noted that during the determination of the technical level of a product in the process of its development, delivery to production, and certification by quality categories cases of the distortion of information on the achieved world level occur, which does substantial economic harm to the national economy.

The USSR State Committee for Science and Technology jointly with the USSR Academy of Sciences, ministries, and departments has been commissioned to carry out the radical restructuring of the work of all information organizations and services, having in mind the establishment of an effective information service of the country for the constant and purposeful supply of specialists with the necessary information on the latest achievements and trends of the corresponding directions of scientific and technical progress.

At present a set of strategic and long-range steps on the restructuring of the system of scientific and technical information, which encompass the streamlining of information organizations, the improvement of technology, the material and technical base, and the gathering and processing of information, the strengthening of the personnel potential of information science, and a number of other aspects of the more efficient organization of information work, has been specified. But this is only the beginning. Some work also has to be done on the creation of the necessary economic prerequisites for the mass dissemination of effective innovations. These include the settlement of a number of questions. These are first of all the additional stimulation of developers and information workers for the turning over of scientific and technical achievements to a wide range of users, the increase of their skills (information culture), the determination and the inclusion in the realm of management of economically sound prices for information services as a universally recognized product, the organization of the "in kind" exchange of information, which is different in its economic return, the changeover of information organizations to cost accounting, the determination of the system of interrelations with information databases of other countries, and several other problems.

The time has come for economists to join most actively in the implementation of this process. The changeover of associations, enterprises, and organizations of various sectors of the national economy to the principles of full cost accounting and self-financing imperiously requires of economists the mastering of another area of work, which is unusual for them.

7807

Discoveries Registered by Committee for Inventions, Discoveries

18140125 Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 10, Oct 87 pp 137-142

[Article under the rubric "News Items and Information": "In the USSR State Committee for Inventions and Discoveries"]

[Text] There have been registered the scientific discoveries:

"The Property of Beta-Radioactive Solid Dielectrics to Accumulate Nonuniformly by Depth a Positive Electric Charge in a Volume." The authors of the discovery: V.V. Gromov, V.I. Spitsyn.

The formula of the discovery: the previously unknown property of beta-radioactive solid dielectrics to accumulate nonuniformly by depth a positive electric charge in the near-surface layer with a thickness on the order of the length of the path of beta particles in this material, which is due to the emission of beta particles, was established.

The priority of the discovery is 2 July 1970. Certificate No 324.

The essence of the discovery consists in the fact that as a consequence of the transfer of a charge in case of the emission of beta particles a positive electric charge is accumulated in the near-surface layer of solid beta-radioactive dielectrics (glass, crystalline compounds, ceramic materials, and others). Similar effects also occur in case of alpha- and gamma-radioactive specimens. A near-surface charged layer forms in materials with a specific resistance that exceeds 10^{10} ohms per meter.

The magnitude of the volume density of the charge is proportionate to the beta-activity of the dielectric and its dielectric constant and inversely proportionate to its conductivity. In case the radioactive object is in a conducting medium (water, ionized gas), the compensation of the charge from the surrounding space occurs, and the object as a whole becomes electrically neutral, but the nonuniformity of the distribution of the charge in the volume is preserved. The arising electric field can achieve breakdown voltages, which is capable of causing the mechanical breakdown of highly radioactive materials.

The scientific significance of the discovery consists in the detection of a fundamentally new property of radioactive solid dielectrics, which is grouped with such basic properties of radioactive materials as the release of heat and light, the ionization of the environment, and biological action.

The practical significance of the discovery consists in the possibility of the devising of high quality adsorbents, luminescent instruments, and catalysts and the development of new technological processes with the involvement of solid high-resistance radioactive substances. The appearance of an electric charge gradient in the volume of solid radioactive dielectric materials should be taken into account when predicting the behavior of solidified, including vitrified, radioactive wastes in time.

"The Law of the Breakdown of Discrete Symmetries in Weak Interactions of Elementary Particles." The authors of the discovery: B.L. Ioffe, L.B. Okun, A.P. Rudik.

The formula of the discovery: the previously unknown law of the breakdown of discrete symmetries in weak interactions of elementary particles, which consists in the fact that the breakdown of reflection symmetry, which leads to spatially odd pair correlations of the spins and momentums of particles, is accompanied by the breakdown of the charge symmetry, was established theoretically.

The priority of the discovery is 21 November 1966. Certificate No 325.

By the symmetry of the laws of physics, which establish the connection between the quantities which characterize a physical system, there is meant the invariability of these laws in case of specific transformations, which the physical system can undergo. Practice has shown that physical laws are symmetrical (invariant) with respect to the following most common transformations: the change of the start of the reading of time, the transfer and rotation of the physical system as a whole in space.

In classical and quantum mechanics and classical and quantum electrodynamics other types of symmetries, which, in contrast to the listed ones, are discrete symmetries, are also examined. These are symmetry with respect to spatial inversion P (a transformation which corresponds to the transition to a system that is a mirror image of the original physical system), symmetry with respect to time reversal T (the change of the direction of the flow of time in the opposite direction), and symmetry with respect to charge conjugation C (the transition from particles to antiparticles).

Prior to 1956 it was considered universally recognized that all interactions of elementary particles have these discrete symmetries. In the summer of 1956 in connection with the contradictions, which emerged during the description of new experiments on the weak interactions of elementary particles, American physicists Lie and Yang advanced the hypothesis that spatial inversion can be break down in weak interactions and indicated the experiments, in which this hypothesis could be verified.

B.L. Ioffe, L.B. Okun, and A.P. Rudik in the fall of 1956, on the basis of the Luders-Pauli theorem of the invariance of all interactions with respect to the simultaneous making of three transformations—P, C, and T, which was proven shortly before this, and the fact of the existence of the long-lived K^0-meson, established theoretically that the breakdown of spatial inversion should be accompanied without fail by the breakdown of one of the two other discrete symmetries with the (at least approximate) conservation of the other.

The authors of the discovery also established that a positive result of the experiments suggested by Lie and Yang should signify that in weak interactions not only the P-symmetry, but also the C-symmetry break down.

Moreover, they proposed a number of other experiments, in which it would be possible to ascertain directly whether the C-symmetry and T-symmetry are preserved in nature.

In early 1957 in experiments on weak interactions, which were performed by American physicists, breakdowns of the P- and C-symmetries were detected. Subsequently similar experiments were conducted in the USSR and other countries. The experiments suggested by the authors, from which the breakdown of the charge symmetry in weak interactions directly followed, were also conducted.

This discovery became a part of the bases of the theories of universal weak interaction, and then common electroweak interaction. According to present cosmological notions, the disturbance of the CP-invariance is a necessary conditions for the explanation of the origin of our surrounding world with the observable asymmetry between particles and antiparticles.

"The Phenomenon of the Transformation of the Organic Matter of Sedimentary Rocks Under the Action of Tectonic and Seismic Processes of the Earth's Crust." The authors of the discovery: A.A. Trofimuk, N.V. Charskiy, T.I. Soroko.

The formula of the discovery: the previously unknown phenomenon of the transformation of the organic matter of sedimentary rocks under the action of tectonic and seismic processes of the earth's crust, which consists in the increase of the carbonization and generation of hydrocarbons as a result of mechanical reactions, which originate under the action of variable mechanical stresses, was established experimentally.

The priority of the discovery is 21 April 1982. Certificate No 326.

The authors discovered the previously unknown phenomenon of the transformation of the organic matter of sedimentary rock under the action of tectonic and seismic processes of the earth's crust. The discovery was established at the Institute of Geology and Geophysics of the Siberian Department of the USSR Academy of Sciences and the Institute of Physical Technical Problems of the North of the Yakutsk Affiliate of the Siberian Department of the USSR Academy of Sciences. Knowledge of the peculiarities of the mechanisms of the formation of natural hydrocarbons, as well as coals is necessary for the development of methods of the exploration and prospecting of accumulations of these minerals.

The question of the motive forces of the processes of the conversions of source (parent) organic substances into petroleum and natural gas, as well as the metamorphism of coals was a topic of debate of scientists during the entire present century.

Prior to the publication of the work of the authors researchers had not found an explanation of the contradictions between the actual geological materials, which indicate low temperatures of petroleum and gas formation (less than 100 degrees Celsius) under natural conditions, and the data of experimental laboratory research, during the conducting of which it was possible to implement the processes of the generation of petroleum at temperatures above 200-250 degrees Celsius.

The authors of the discovery established that in case of elastic and plastic deformations of rock under the conditions of natural bedding their mechanical activation occurs, as a result of which a wide range of physical chemical processes occurs. Among them are mechanochemical reactions, the thermodynamic parameters of which in practice do not depend on the temperature of the medium. Therefore, in deformable rock at low temperatures (less than 100 degrees Celsius) high temperature reactions, including petroleum and gas formation, occur.

A large series of experimental laboratory tests, during the implementation of which the effect of tectonic and seismic processes on rock was simulated, was conducted for the verification of this conclusion. As a result of the studies it was established that under the action of weak elastic deformations with a frequency of up to 30 hertz at temperatures of 20-70 degree Celsius in the undissolved portion of the organic matter, which is contained in rock specimens, an increase of the content of carbon and a decrease of hydrogen, the loss of oxygen-containing and aliphatic functional groups, and the increase of the role of aromatic structures, included condensed structures, occur. The content of hydrocarbons increases substantially in the composition of soluble components of the organic matter. In their parameters these transformations are analogous to the natural processes of the metamorphism of fossil organic matter and the generation of hydrocarbons.

The reliability of the peculiarities of the transformation of fossil organic material, which were identified as a result of the experimental studies, is confirmed by a large quantity of factual material which was obtained during the study of natural objects.

The degree of transformation of the concentrated and dispersed forms of organic matter in sedimentation basins increases as one gets closer to their folded frame, that is, is directly connected with the intensity of the seismic and tectonic action, which is maximal within orogenic structures.

The scientific significance of the discovery consists in the fact that it was proven for the first time that not only the heat component of the released energy of the earth, but also the mechanical component are the motive force of the transformation of fossil organic matter. This made it possible to substantiate the assumption of the possibility of the formation of a wide range of hydrocarbons

under natural conditions at low formational temperatures (less than 60-70 degrees Celsius), in zones with increased tectonic and seismic activity.

The practical significance of the discovery consists in the fact that the parameter "the tectonic and seismic activity" of a region was advanced as a criterion of the evaluation of the productivity of zones of the generation of hydrocarbons and the degree of metamorphism of coals. Its use made it possible to substantiate the possibility of discovering accumulations of hydrocarbons in the thin sedimentary mantle of individual regions of dry land and ocean areas.

"The Phenomenon of Combine Resonance in Crystals." The author of the discovery is E.I. Rashba.

The formula of the discovery: the previously unknown phenomenon of combined resonance in crystals, which consists in the fact that under the action of the electric component of an exciting electromagnetic field of resonance frequency transitions between the quantum states of electrons (holes) with a change of the orientation of their spin and the conservation or change of the orbital state occur, and is due to the spin-orbit interaction of electrons in crystals, was established theoretically.

The priority of the discovery is 7 October 1959. Certificate No 327.

Among the most important problems of solid-state physics is the study of the behavior of electrons in crystals, particularly the interaction of electrons with an electromagnetic field. It is well known that an electron has an electric charge and a spin magnetic moment.

The interaction of the spin magnetic moment with a magnetic field is being extensively studied and used in science and technology. Electron paramagnetic resonance (EPR), which was discover by Ye.K. Zavoyskiy in 1944, is one of the manifestations of this interaction. It is found from the absorption of an electromagnetic wave by spins, which is due to their interaction with the magnetic field of the wave. Here only the waves that have the resonance frequency, which is governed by the frequency of the motion of the electron spin, are absorbed.

The essence of the discovery consists in the fact that in a crystal, which has been placed in an electromagnetic field, the spins of the electrons interact not only with the magnetic component of the field, but also the electric component.

The author showed theoretically that there are conditions, under which the action of an electric field on the spin is even stronger than the action of a magnetic field. Here the absorption of electromagnetic waves of resonance frequency by electron spins occurs due to the interaction of the spins both with the magnetic field of the wave and with the electric field of the wave, and resonances are observed not only at the frequency of electron paramagnetic resonance, but also at new frequencies.

The set of phenomena, which are connected with the excitation of spin transitions by a variable electric field, received the name of combined resonance. Later combined resonance was detected experimentally in many crystals and was studied by independent groups of scientists. The results of experiments completely confirmed the predictions of theory.

The scientific significance of the discovery consists in the fact that it changed radically the notion of the mechanism of the interaction of the spin moment of an electron with an electromagnetic field in crystals. It stimulated a number of studies, in which new manifestations of the interaction of electron spin with an electric field, particularly the spin combination scattering of light and others, were discovered.

The practical application of combined resonance is based on its high intensity and the presence in its spectrum of a significant number of bands. Owing to this combined resonance at present has turned into a practical method of studying the electrical spectrum of electrons in crystals, including the subtle peculiarities of their dynamics, and of studying the geometry of various defects of the crystal lattice. Quantum electronics is a possible area of technical applications of combined resonance. Among the developed semiconductor lasers are adjustable lasers that operate on the basis of spin combination scattering.

"The Phenomenon of the Redistribution of the Energy of Charge Carriers in Metal Microcontacts at Low Temperatures." The authors of the discovery: Yu.V. Sharvin, I.K. Yanson, I.O. Kulik, A.N. Omelyanchuk, R.I. Shekhter.

The formula of the discovery: the previously unknown phenomenon of the redistribution of the energy of charge carriers in metal microcontacts at low temperatures, which consists in the formation under the action of applied electric voltage of two groups of nonequilibrium charge carriers (energy duplication) with the maximum energies, which are differentiated by magnitude and proportional voltage, is due to the conservative nature of the motion of the charge carriers, and appears in the nonlinearity of the dependence of the magnitude of the current on the voltage, was established.

The priority of the discovery is 30 December 1964 in the area of the theoretical substantiation of the formation under the action of electric voltage of nonequilibrium states of charge carriers, 10 July 1973 in the area of the experimental establishment of the phenomenon, and 11 March 1977 in the area of the theoretical explanation of the physical nature of energy duplication. Certificate No 328.

Until recently the notion that in metals the deviations from equilibrium in electron and phonon systems, which occur in the process of their heat and electric conduction, are small, was universally recognized and the creation of a highly nonequilibrium system of electrons, which interact in a nonlinear manner with phonons, was considered impossible.

The authors of the discovery proved theoretically and experimentally that the indicated notions are entirely inapplicable when an electric current is passed through a metal waist of the smallest dimensions (on the order of several hundreds or tens of angstroms), which connects two solid metals. In such waists, which received the name of microcontacts, a substantially nonequilibrium state of the electron-phonon system occurs under the action of a flowing electric current, moreover, the magnitude of the nonequilibrium can be evenly regulated by the difference of the electric potentials eV, which has been applied to the microcontact. The highly nonequilibrium stationary distribution of electrons, which has been localized in small areas of space, is a quantum state of a new type with the function of the distribution of particles, which does not have analogs in modern solid-state physics. All electrons are divided into two groups, the maximum energies of which are differentiated by the value of eV (the energy duplication of nonequilibrium charge carriers). Here the flow of a current in a microcontact is accompanied by the radiation of phonons, the energy of which is close to the maximum possible energy in crystals.

The results of the work of the authors were completely confirmed in numerous experiments which are now being conducted in laboratories of various countries.

The scientific significance of the discovery consists in the fact that it made cardinal changes in the notions of kinetic phenomena in metals as linear weakly nonequilibrium processes. In the physical kinetics of metals a new direction appeared—nonlinear phenomena and structural changes of the state in systems with a concentration of current.

The practical significance of the discovery consists in the fact that on its basis the authors developed a new method of the spectroscopy of electron-phonon interaction, as well as the interaction of electrons with other quasiparticle excitations (magnons, excitons) in solids, which is being used extensively in world practice and has received the name "microcontact spectroscopy." Microcontacts, in having nonlinear properties in the area of high and microwave frequencies, are promising from the standpoint of their use in microwave and infrared equipment, especially when the use of superconducting devices is impossible, for example, in case of strong magnetic fields.

"The Property of the Ion Canals of the Synaptic Chemoreceptors of Man and Animals to Interact Selectively With Substances That Disrupt Synaptic Transmission." The authors of the discovery: V.I. Skok, A.A. Selyanko, V.A. Derkach.

The formula of the discovery: the previously unknown property of the ion canals of the synaptic chemoreceptors of man and animals to interact selectively with substances that disrupt synaptic transmission, which appears in the greater affinity of blockers to some canals with respect to others and is responsible for the selectivity in the disruption of the chemical transmission of stimulation and inhibition in the nervous system, was established experimentally.

The priority of the discovery is 18 July 1980. Certificate No 329.

The essence of the discovery consists in the establishment of the previously unknown property of the selective chemical sensitivity of the ion canals of the synaptic chemoreceptors of man and animals.

It is well known that the nerve cells of man and animals exert a stimulating or inhibiting influence on other cells by the excretion of chemical transmitter substances, which interact with the protein chemoreceptor molecules, which are incorporated in the surface membrane of the receiving cell at the sites of intercellular contacts (synapses). As a result of such interaction a microscopic pore—an ion canal, which penetrates the surface member of the cell, is opened in the molecule of the chemoreceptor. A flow of ions, which also causes the stimulation or inhibition of the cell, rushes through the opened canals.

In physiology and medicine substances, which decrease the sensitivity of chemoreceptors of the necessary type, are injected in the body to halt the transmission of stimulation or inhibition. Such selectivity in the interaction of chemoreceptors with substances is possible as a result of their having selective chemical sensitivity to substances, which specifically disrupt the synaptic transmission through chemoreceptors of precisely this type. It was believed that only those areas of the molecule of chemoreceptors, which also interact with the transmitter substance or in some way influence this interaction, have such selective chemical sensitivity.

The authors of the discovery when studying the mechanism of the action of pharmacological preparations on the cells of the autonomic ganglion of mammals by electrophysiological methods obtained results, which are inconsistent with the above-indicated traditional notions, and formulated the fundamentally new assumption of physiology that the ion canal of chemoreceptors in an open state has the property of selective chemical sensitivity, owing to which specific substances, when interacting with the open canal, are capable of blocking it in some chemoreceptors, without affecting others, by which the specific disruption of synaptic transmission in cells of the necessary type is achieved.

The scientific significance of the discovery consists in the fact that it changed the previously existing notions about the molecular mechanisms of the control of the

activity of the synaptic chemoreceptors of man and animals. The discovery makes it possible to explain several thus far unclear phenomena, such as the lack of structural similarity of the transmitter substance and the specific blocker, as well as the selective blocking by specific substances of some synapses in preference to others in case of the complete identity of their mediator mechanism.

The practical significance of the discovery consists in the fact that it indicates fundamentally new approaches in the development of pharmacological preparations, which are intended for the control of the activity of the nervous system of man and animals, with the use of the rate of their binding with the open ion canal as a quantitative indicator for the prediction of the selectivity of the action of blockers.

If within a year from the date of the publication on the registered discovery in the bulletin *Otkrytiya. Izobreteniya* the registration is not contested in accordance with established procedure, the USSR State Committee for Inventions and Discoveries in conformity with Paragraph 19 of the Statute on Discoveries, Inventions, and Efficiency Proposals issues certificates for the discovery and pays the authors a reward.

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Development of Computer Technology In CEMA Countries

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[Article under the rubric "Round Table Conference": "Computer Technology in the National Economy. Experience, Problems, Perspectives"; first six paragraphs are *Journal of the CMEA Secretariat* introduction]

[Text] The present phase of scientific and technical progress is characterized by a comprehensive change in production. The primary conditions are not the elaboration and implementation of some independent advanced technical innovations, but rather the realization of complete technological systems based on essentially new technologies and materials, an organic combination of electronics and industrial production, and advanced forms of the organization of production and management.

Computer technology is often considered as a catalyst of scientific and technical progress. Automated information processing systems and production management systems, among them flexible production systems, automated projecting systems, as well as control systems integrated in various sorts of apparatus, machines, and equipment, have been developed on this basis and on the use of communication technology.

The degree and pace of the economic development of the CEMA member countries are such that the improvement of production cannot be effected without integrating the economic, scientific, and technical capacities of the countries and without international division of labor.

In the present phase of development, the basis of coordinated action by the countries of the socialist community for the creation and utilization of essentially new technologies in their economies is the Comprehensive Programme of Scientific and Technical Progress of the CEMA Member Countries to the Year 2000, in which the electronization and comprehensive automation of the economy is one of the priority points.

At the latest congresses of the Communist and Workers' Parties of the socialist countries, the growth of the output of the production of means of computer technology, the extension of their application, as well as wider international cooperation in the creation and implementation of advanced technologies, have been determined.

The contributions of experts from Czechoslovakia, Hungary, Poland, and the Soviet Union, who participated in the round table conference organized by the present periodical, describe the existing park of computer technology, its utilization in the economy, the ways of increasing the efficiency in the use of means of computer technology, inter alia those based on existing capacities of the participating countries.

Lajos Varga

Head of the Department of the Central Statistical Office of Hungary, deputy representative of Hungary in the Council for the Use of Computer Technology

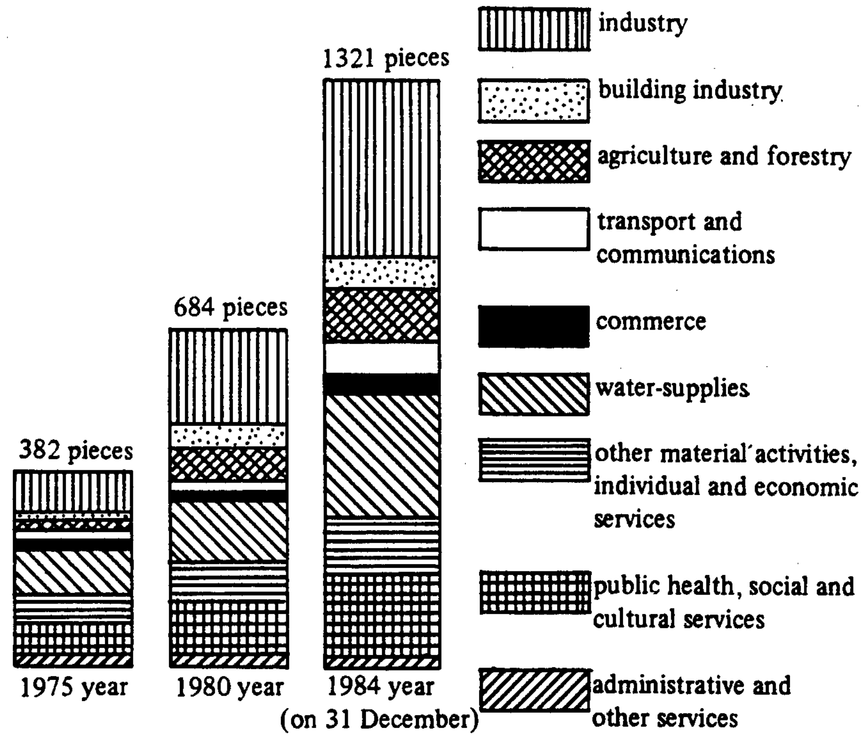
In Hungary, supplies of software and the use of computer technology are controlled by the Central Statistical Office.

It was stressed in the documents of the 13th Congress of the Hungarian Socialist Workers' Party (March 1985) that the change to intensive development depends, to an increasing degree, upon the extended use of means of electronics, in particular those of microelectronics. It demands the electronization of the whole economy and represents a new phase in scientific and technical progress. It makes an essential impact on social and economic activities.

Computer technology is in use practically all over the economy: in about 4-5,000 organizations. In the course of the 6th Five-Year Plan, in conformity with international trends, the production of hard- and software, in particular that of micro- and minicomputers, increased dynamically. This is also evident in the level of investments in the development of the computer park, the value of which amounts to 3,000 million forints. However, the growth of the park, being mainly due to the

Distribution of the computer park in the different sectors of the economy

(not counting mini- and microcomputers, in accordance with the sectoral nomenclature valid since 1 January, 1982)



increase of the production of microcomputers, is accompanied by a systematic decline of the proportion of the volume of new technologies to that of the whole park because of the low volume of scrapped machines. That ratio was 51 percent in 1980, 45 in 1981, 46 in 1982, and 44 percent in 1983. For organizations financed by central funds the ratio was 30-40 percent.

The number of companies and organizations using computer technology is continuously growing. By 1 January 1986, means of computer technology were widely used in about 75 percent of the organizations of the Hungarian economy. That means that the number of persons utilizing such technologies is also growing.

The figure shows the distribution of the park of computer technology in the different sectors of the economy. At the end of 1984, 1,321 high performance computers and 15,368 micro- and minicomputers (for general applications, professional, and personal computers) were owned by organizations keeping their own accounts, including 5,980 computers used by small cooperatives.

The overall value of machines used by firms, cooperatives, and other organizations keeping their own accounts is: large computers over 22,000 million forints, mini- and microcomputers—6,6 thousand million forints. So the whole park of means of computer technology is estimated to be of a value of about 30,000 million forints, that is, 18.4 percent higher than in 1983.

Of the machines, 35 percent operate in the health services, as well as social and educational services (14 percent in 1983). This is due to the introduction of microcomputers in education. A more accelerated growth in the use of computer technology can be observed in water management and agriculture, as well as in services. Here, the number of computers doubled, as compared to 1983.

The growth of the computer park was slower in trade, industry, and construction engineering, but even there their number increased by about 50 percent.

The wider application of means of computer technology can reduce the quantity of human labour. It is expected that, as a result, the need for investments will grow, in particular as regards the production of microcomputers. The structure of demand is still influenced by price. The

increase in home production and the import of microcomputers led to a decline in prices, while the import of expensive high-performance computers is limited.

The costs of software are determined by the high quantity of human labour they contain. This factor will stimulate the import of programmes (that is, materialized labour) and the automation of their preparation.

As the demands for means of computer technology will continue to grow, it is necessary to take comprehensive measures for the stimulation and reorganization of the control of activities related to the wide application of means of computer technology in the different sectors of the economy in Hungary.

At present, in the majority of ministries and other authorities, the information necessary for the decisions is received, to a large degree, through automated processing of accounting, statistical, and sometimes also operative data.

The extension of the application of computers in the 7th Five-Year Plan should stimulate innovation. There are already microcomputers of different categories, which are, at relatively small capital cost, accessible for practically all organizations. It is envisaged to elaborate a network of computers of different standards to attain a multiple growth in the degree of utilization of the existing means of computer technology. However, a start cannot be made on the solution of that problem before the establishment of the necessary conditions of communication (lines, hardware, programmes). It will also be necessary to change the existing equipment of organizations (bookkeeping, machines, calculators, and so on). Such a change will be possible by the application of microcomputers.

In the interests of the users it is important to define and introduce the relevant quality control methods. In international relations, coordinated activities are needed for the improvement of the quality of jointly developed means of computer technology. One of the most important duties at the national level is the elaboration of the conditions of giving access to information services to ordinary citizens and the planning of their realization.

An important factor of the wide diffusion and effective utilization of computer technology is the assurance of the individual conditions of their application.

The satisfaction of the demand expected after 1990 should be kept in mind for the training of staff in the framework of institutional education in the course of the 7th Five-Year Plan. As the utilization of computer technology makes an impact on all spheres of social production, it is necessary to provide for the training of skilled staff and also that of experts in its creation and development. We must be ready to face the fact that in Hungary the number of persons using microcomputers and personal computers in the economy and in management will reach about 100,000 by the end of the next five-year plan. This is why it is important to continue intensively and extend the programme of the development and implementation of school computers and to assure, within that programme, the necessary resources for covering the relevant costs.

One of the basic conditions of the extension of the use of computer technology in the whole of society is the elaboration of standards and requirements concerning its quality, the determination of the efficiency of its utilization, and compatibility.

It is indispensable to make sure that information technology be completely covered by the system of unification and standardization.

In its framework, it is not necessary to unify all hardware and software, but it is imperative that the information content be identically understood, and standards must be elaborated to allow an exchange of data on computer data carriers, assuring the adoption of a common structure of the database, establishing connections for the teleprocessing of data at the level of the user.

In the standardization and unification of hardware, software, data teleprocessing systems, and the technology of their design, it is necessary to cope with standardization in a centralized manner. The existing sectorial standardization system must be reviewed and new bases must be provided for a system embracing entire information technologies that are capable of determining and developing a standardization and unification system compatible with international standards.

Under the present conditions, when the economic development of the CEMA member countries reached a high level, a comprehensive approach to economic activities, leading to a growth in their efficiency and taking into account all phases of the science-technology-production-sales cycle, was stressed. The identified trends should then be realized through cooperation within the framework of the CEMA and the Intergovernmental Commission for Cooperation in Computer Technology of the CEMA Member Countries. It seems advisable to carry out joint developments and also to make use of existing experience in software. However, the present practice of cooperation does not fully correspond to modern requirements.

International trade in software is insignificant. Some is part of scientific and technical cooperation and the supply of some equipment. A zero balance in the exchange appears to be desirable.

Those cooperating are informed about technical development and existing software only by chance. The national members of the Council for the Use of Computer Technology of the Intergovernmental Commission for Cooperation in Computer Technology of the CEMA

Member Countries have access to the necessary information on a large quantity of technical means for computer programmes in some institutes elaborating or using such programmes, which might be used in other CEMA member countries and are not available in the central pool. In Hungary, for example, there is a well-defined demand for computer software. There is a need for software for the remote processing of data available in other socialist countries; we need systems for programme developments, allowing a profitable elaboration of transferrable programmes. Due to the absence of basic programmes for the Unified Computer System and for the System of Minicomputers, we are obliged to develop individual programmes or buy them in Western countries. We need a large quantity of cheap microcomputers of the professional type to assure efficient labour. We recognize that a rapid satisfaction of our needs goes beyond the possibilities of the Hungarian representative of the Council for the Use of Computer Technology, but, in time, bearing in mind economic interests, the problems can be solved.

Krzysztof Urbanecz

Assistant professor, doctor of technical sciences, representative of Poland in the Council for the Use of Computer Technology

Computers in Poland are considered as a factor of the acceleration of economic progress. It concerns, in particular, their adaptation for the improvement of the work of the government administration; the growth in the efficiency and intensity of economic activities of firms, raising their technical level; the improvement of the quality of newly designed products; the acceleration of their preparation and manufacturing period; and the reduction of production costs.

Under the given conditions, there are some difficulties in the use of computers in these respects. According to the data of the Chief Statistical Department, the following main fields for computers can be determined, based on their utilization within a period of 1 year: 68.4 percent in the management systems of state industrial firms and other organizations, 18.5 percent in systems for the automation of professional work (including forecasting), and 13.2 percent in the automation of technological processes.

In my opinion, the following rates of application of means of computer technology in the priority areas of the economy should be envisaged as a rough percentage of the overall operating time of all computers: about 40 percent in management systems, about 40 percent in systems for the automation of professional work, and about 20 percent in the automation of technological processes.

It is quite evident that the necessity for change in the present ratios requires growth in the production of computers, as well as substantial intensification of software development.

The sphere of application of computer technology will be extended primarily in connection with the automation of professional work in industry, transportation, science, education, health services, and state administration. It can be assumed that it will also contribute to the growth in labour efficiency and the improved training of economists, (among them, those working on the structural improvement of industrial production—that is, on the design and manufacture of new products).

Software for new fields of application of computers, in particular for microcomputers, are a new problem. At present, a number of organizations deal with this in Poland, and highly-qualified people are active in that field. A plan for the allocation of their duties is being drafted. Programmes of scientific research and experimental construction work have been elaborated for 1986-1990 for the solution of problems such as the comprehensive automation of production, the application of computers in industry, and the development of automated management systems for the state administration. It will be necessary to take measures for the development and propagation of software for computers, including for the standardization and unification of applied programmes, programme packages, and programme systems.

An indispensable factor is, naturally, an extensive training of staff, in particular in secondary schools and colleges. It is also envisaged that extension training be organized for specialists in computer technology and for users. The present system of training must be changed so that the skill to be attained in the computer field should be closely related to the professional training of the relevant person.

When starting our national programme, we hope to get the necessary support from our partners in the Council for the Use of Computer Technology. In January 1985, at the 9th meeting of the council in Warsaw, the delegations of the cooperating countries, considering the joint activities for the period of 1986-1990, identified the priority objectives of common work. These are the development and implementation of:

—systems for the automation of projecting works in the national economy;

—automated systems for the control of technological processes;

—comprehensive automated management systems for use in industrial enterprises and the nonindustrial sphere;

—training systems for staff using means of computer technology.

The problems of cooperation are, to a large extent, the same as those of essential importance for Poland. It should be stressed that, in close relation with multilateral cooperation, we also develop bilateral operative contacts. We could mention a number of examples of such successful cooperation of Polish organizations with enterprises in Bulgaria, Hungary, and the Soviet Union. In the plans for bilateral cooperation for 1986-1990, the establishment of a Polish-Soviet institute for the production of software is of particular interest.

We hope that in the course of cooperation, we shall succeed not only in making use of the experience of our partners, but also in offering them the results of our own development. At the international software exhibition in April 1985, in the Coordination Centre of the Intergovernmental Commission for Cooperation in Computer Technology in Moscow, we displayed over 100 packages and programme systems intended for export. Beside that, about 30 packages of applied programmes developed by Polish organizations successfully underwent international tests and were included in the Common Collection of Applied Programmes of the Intergovernmental Commission for Cooperation in Computer Technology.

Yuri Lapshin

Doctor of economics, deputy head of the Department of the State Planning Board of the Soviet Union, deputy leader of the Council for the Use of Computer Technology

In the last five-year plan of the Soviet Union, a number of problem-oriented uses of computers were identified in the automation of information processing related to the intensification of production and control processes. It is envisaged that automation should embrace:

—scientific research and projecting construction work, as well as the technological preparation of production;

—information processing used in organizational and economic management;

—training.

The development of these, and their share in the overall volume, depend on the skills of users and that of the conformity of software and hardware parameters with the requirements and conditions of effective automation.

About 20 percent of the production of computers were used in scientific research and projecting organizations. Up to the present, in a number of branches of mechanical engineering and metal processing, the process of product development has been automated up to 80-90 percent.

Automated systems for the control of technological processes were developed primarily in industries with continuous production methods, such as fuel-energetic complexes, metallurgy of ferrous and nonferrous metals, chemistry, and transportation, as well as in a large number of individual technologies in mechanical engineering and metal processing.

The 11th Five-Year Plan represents some sort of a start in the wide use of automated systems for the control of technological processes based on microprocessor apparatus and controlled by microcomputers fitted into the machines, instruments, and equipment. For such purposes, about 20 percent of the overall volume of means of computer technology intended for control functions was used, and their range continues to grow. At present, various kinds of equipment are made with modern means of control: nuclear and heat-generating energy blocks, rolling mills, various diagnostic systems, training devices, and so on.

Between 1981 and 1985, over 2,700 automated systems for the control of technological processes were established, mainly at existing plants, and were applied to existing equipment. The use of such quantities of computers led to new quality control not only at the individual objects, but also in an industry as a whole, that is in energetics, in the petroleum, gas, and coal industries, various sorts of transport, geology, and so on.

In electrical energy, a system using computer technology was established and is in operation, embracing the planning of production and the distribution of electrical energy, as well as the operative control of power energetics.

In rail and air transport, a system of automated bookings, based on the systems "Express" and "Siren" are in use at all selling points. This increases the payload of trains and aircraft, reduces the number of booking clerks, and, what is even more important, saves time.

As a result of the automation of organization and management, industry and firm automated management systems, as well as those for information processing in different organizations, have been developed. About 30 percent of the means of computer technology produced under the past five-year plan were used.

Such systems operate in statistical services, in banking and finances, in organizations of material and technical supply, and in trade and public health.

A major part of the existing computer centres in our country (over 80 percent) operate within industrial companies, as departments for information processing. The

majority of them, in addition to a series of other functions, is engaged in carrying out one major task: the operative management of production. That is actually the case both in companies with individual and series or mass production, for after all, automated operative management is related to the control of material flows, assuring continuity and rhythm in production. The use of such a system at the Volzhsky Automobile Works shows that the computer centre of that association is mainly engaged in the planning of the daily duties of those who assure the conditions for the operation of the main conveyor belt. That system may be considered as organizational and economic, while similar systems in companies with a production of discrete character may well be described as systems of technological management. In case of a wide application of flexible production and automated projecting, such systems represent the only possibility for synchronizing all elements of the complex manufacturing system.

Under the present conditions of developed cooperation in production, with a large variety of components and end products, as well as a wide range of users, it is impossible to assure a balanced rhythm of production, material and technical supply, distribution, and realization of the products without improving the whole mechanism of the control of those processes.

The computerization of large spheres of the economy and human activities implies much work in the training of staff who are able to use the most advanced means, for the improvement of management and for the automation of different kinds of human working functions. That is why in the last five-year plan the automation of training was introduced in universities and institutes.

In the period of 1981-1985, the use of computer technology in the fields mentioned above underwent large-scale development. The effectiveness of each of them can be shown through the examples of both local objects, some sectors, and the national economy as a whole. The criteria of effectiveness were the coefficients of return on investments in computer technology, approved by the State Planning Board of the Soviet Union. For the different industries, the coefficient varies between 0.3 and 0.45, with a view that the coefficient for the total national economy be at least 0.37 (as compared to 0.3 in the 10th Five-Year Plan). The main point is a reduction in prime costs.

The use of computer technology (having sometimes limited technical and economic parameters) in the 11th Five-Year Plan allowed a number of industries to improve the quality of management and information processing; it led to some changes in the economy of those sectors of the economy. In the course of that period, the most effective ways of further development also during the 12th Five-Year Plan were identified.

The basic document, defining the place and scale of work to be done both in the economy as such and in some particular field of automation of management and information processing, is the National Programme of the Creation, Production, Development, and Effective Utilization of Computer Technology and Automated Systems to the Year 2000. In that programme, concrete objectives are defined for each 5-year period concerning the level of automation of machines, instruments, and equipment, scientific, technical, and projecting works, and of the organizational-economic management for the most important industries. The parameters and the dynamics of their change are also determined in accordance with the computer available, together with the organizational principles of their use. The rate of development is calculated and the economic characteristics of the effectiveness of the automation of management and information processing are specified.

It is necessary to stress some essential peculiarities which must be taken into account in that period. The first is that the parameters of the means of computer technology will improve. The speed of the computers for general application will increase threefold, practically without any change in their prices, the volume of the operative outside memories will grow two- to threefold, and so their productivity will also increase substantially. The new parameters of the computers, the latest versions of the operational systems and those of basic software, as well as the large quantity of terminals, makes it possible to develop active work in dialogue system.

In the course of the present five-year plan, the economy will be supplied with a large number of personal computers. This will allow the creation of many automated jobs with different problem orientations. Such jobs, provided with various sets of peripheral equipment and the relevant software, will be installed in fields where the largest quantity of human labour is applied. As a result, for example, the activities of constructors, technologists, and those engaged in control will automated, that is, the work of those who prepare various documents. Such development will set free an important part of the staff engaged in the national economy.

Important allocations are expected to the automation of projecting: to the establishment of automated projecting systems. The volume of that work will increase more than sixfold as compared to the past five-year plan. The realization of automated projecting systems requires the development of special problem-oriented software complexes to be used at automated jobs.

As to the automation of technological processes with the extended use of microprocessor technology and microcomputers, work started during the five-year plan will be continued. That embraces the automation of both existing production capacities and new ones.

In the present five-year plan, the creation of organizational economic systems of information processing will go on both at the industry level and in the individual firms and organizations.

It is necessary to identify the objectives, the realization of which are directly related to the basic planned characteristics (such as the output of production, income, reduction of costs, staff number, and so on) for the evaluation of the planned characteristics of the automation of organizational economic management.

In the present five-year plan, the highest rate of computer supplies will be assured in training in primary trade, secondary, and tertiary education. Because of the intensification of the economy, the human factor will continue to be decisive. In the years to come, automation based on the wide use of means of computer technology will be implemented actively in all spheres of work. It is, therefore, important to train staff capable of utilizing in an active way, through those means, the possibilities for the intensification of labour.

The experience gained in the last five-year plan concerning the determination of the technical and economic parameters of computers, and that of the structure of their production, makes it possible to start with improved forms of their application. In the operation of computer systems, the dialogue system will be the most frequently used. The extended use of personal computers with parameters equal to those of the present large computers will make the establishment of small computer centres unnecessary.

Under the conditions of a highly-developed system of automated information processing with such an organizational structure, it will be necessary to establish territorial and local computer networks. That will widen the possibilities of the users and subscribers to those networks, so as to enable them to use not only their own personal computer resources, but also those of other subscribers.

In the National Programme of Computer Technology and Flexible Automated Management Systems, it is envisaged that in the present five-year plan the refund of the allocations to that end should not exceed 2.5 years, that is, the normative value of the effectiveness of investments should be 0.4. That high coefficient of profitability of investments is two- to threefold of that attained in other fields. It must be taken into account that up to 30 percent of the computer resources would be applied in the health services, education, state administration, and so on, where it is rather difficult to evaluate the direct economic effect. In material production, this coefficient might be 0.4 to 0.5. For the calculation of effectiveness characteristics, such as revenue, cost reduction, additional output of production, and relative reduction of staff are applied.

In the present five-year plan, the ratio of sectorial allocations in the implementation of computer technology is 5-6 percent (or more) of the total volume of investment. The specific weight of the above-mentioned characteristics is, according to plan, 7-8 percent, but in some fields, it attains over 30 percent. As a consequence, computers and automated systems establish on their basis will become effective means on influencing the work in the relevant sectors and in the economy as a whole. The expenses related to the production and implementation of computer technology will be important, but without them it would not be possible to attain the set objectives.

The implementation of computer technology in all spheres of the economy and at all levels of the management of the economy is an objective condition for dealing with the main task of economic development, that is, it intensification. This is envisaged in the Guidelines for the Economic and Social Development of the Soviet Union for 1986-1990 and for the Period to 2000, which reads: "It is necessary to implement automated systems in the different spheres of economic activities, in particular in projecting and the control of equipment and technological processes. The level of automation of production will be raised, it value will be roughly doubled."

Jan Laitl and Milada Jiraskova

Czechoslovak representatives in the Council for the Use of Computer Technology

The Czechoslovak economy, in the comprehensive utilization of computer technology, was guided by progress of that technology in the 1970's and, in particular, the conclusion of the intergovernmental agreement of the socialist countries concerning cooperation in research, projecting, manufacturing, implementation, and the use of computers. In 1972, following the example of the Soviet Union, its wide application in the control of both technological and socioeconomic processes got under way.

In the last five-year plan, in conformity with the decisions of the 16th Congress of the Communist Party of Czechoslovakia, the growth in the effectiveness of control was ensured through the establishment of automated control systems, at all levels, based on a consistent implementation of computer technology. The objective of its use, as well as that of the adoption of economic mathematical methods combined with the use of automated management systems of an administrative character and of integrated information systems, was the substantial increase of the effectiveness and the reduction in labour intensity of administration. An important aspect of the electronization of the national economy is the organization of the supply of modern computers with the necessary accessories and programmes, in particular

for the control of technological processes. The manufacture of computers of two systems: those for the Unified Computer System and the System of Minicomputers, is of primary importance.

At the end of 1984 in Czechoslovakia, the total number of computers in use was 4,715; this is 53 percent higher than at the end of 1981. Among them, 773 belonged to the Unified Computer System and 1,128 to the System of Minicomputers. The number of computers belonging to either of the systems increased in 1981-1984 by 90 percent, the major part of them being minicomputers. In the existing national park, computers imported from socialist countries account for 50.7 percent, those produced in Czechoslovakia amount to 39.8 percent, while the rest were imported from capitalist countries.

The figures show the fulfillment of the basic requirement, the orientation of the Czechoslovak economy to the use of computers belonging to the Unified Computer System (ES type computers). However, their use in the different sectors of the national economy is uneven. This can be seen from the statistical data which are used for the evaluation of the total utilization of computers, their productive and inproductive work. The average utilization of the computer ES-1010 was 3,194 hours in 1984, that of ES-1021 was 3,415 hours, for ES-1025 and ES-1026 it was 2,138 hours, for ES-1030—3,591 hours, for ES-1033—3,371 hours, and for ES-1040—3,642 hours.

The average productive work of a digital computer was 3,058 hours in 1981, that is, 73.5 percent of the total time of a double shift use. In 1984, the figure was 2,868 hours or 68.9 percent of the available time. The decline is due partly to the growing number of failures in some of the old computers and partly to the important failure rate of accessories, in particular that of sloppy discs and printers of computers of the third and fifth generations. For these and some other reasons, the multiplied mode of operation of computers is relatively limited.

Automated information control systems have been developed on the basis of a national plan elaborated in conformity with the resolutions of the 16th Congress of the Communist Party of Czechoslovakia and the duties derived from the Comprehensive Measures for the Improvement of the System of the Planned Management of the National Economy, approved by the party and the government of Czechoslovakia in 1980. That conception has defined the main objectives of the establishment of automated management systems. It refers primarily to the automation of the process of planning at all levels of management, to the preparation and combination of all sources of information, and of the flow of information for the evaluation of the reproduction process. A further requirement is the adoption of automated control systems primarily in areas where a major economy of raw materials, energy, and labour must be effectuated and in supply, technical development, and investments, as well as in the participation of the Czechoslovak economy in the international division of labour.

In Czechoslovakia, over 2,000 automated management systems were established, primarily at the level of firms belonging to the ministries of industry and energetics, as well as in banking and insurance. Automated management systems are also being developed in all intersectorial and sectorial organizations and in those of state management where the automated information system of the national committees is in use with full success.

So far computer technology is applied primarily in the sphere of simple management and administration. In the last five-year plan, important results were achieved in the automation of the processing of information necessary for planning, at all levels of management as well as in the simplification of the information flow in some automated management systems. In industrial sectors, they are used mainly in the production of semimanufactured goods, in the management of the main activities, organization, deliveries, and supply of social and economic information. Up to the present, the degree of use of automated systems in the control of technical work and services was insignificant.

In parallel with the progress of computer technology, the objective must be a change from the automation of recording to that of the main management tasks and the unification of the automated management systems of the different levels. The latter allows the automation of planning processes related to the solution of intersectorial and sectorial activities. For that purpose, a number of methodological rules have been introduced, referring primarily to the unification of the information base and algorythms, for information processing, in particular for activities concerning different ranges of manufacture, the main processes of planning, control of developments, and so on. The rules are introduced in the form of standard solution, projects, and programmes.

By now the rules for the establishment of unified systems of indexes of the national economy and for the databases of organizations have been elaborated. The purpose of both systems is the establishment of a unified content of the information base for all management levels and, through that, the assurance of the necessary conditions for the integrated utilization of information and the implementation of data transfer between the individual users, without documents. Those systems will also provide a basis for the communication of the required data to those who are authorized to use those modern computers. Beside that, it is envisaged to elaborate standard algorythms of intersectorial activities, which allow a growth in the efficiency of analytical and projecting work. In this respect, the Ministry of Labour and Social Services has attained the best results.

In the development of automated management systems and their combination, standard programmes have an important role. In Czechoslovakia, computers of the types ES-1025 and ES-1026 have been developed, which cope with the control of production processes in factories. These are the systems MARS and VARS developed within the framework of state scientific and technical development, which operates in a number of mechanical engineering firms. In addition to those systems, standard projects and programmes have been prepared and are used mainly in trade, agriculture, transport, and, in particular, in organizations under the control of national committees.

In the implementation of standard projects and programmes, positive results have been achieved, but there are still some difficulties in Czechoslovakia hampering a wider adoption of standard solutions. It should be noted that the majority of those solutions are intended for use in a confined circle of firms and are not applicable for use in systems based on modules. In order to do that, important modifications are needed, and they sometimes require as much work as that necessary for the elaboration of a new project or programme. In addition, it was not possible to eliminate the sectorial approach or attempts to find individual solutions. Methods for the elaboration of solutions based on standard modules have not yet been established, which would be applicable in each particular case with proper account for the concrete needs and wishes of the users. The implementation of unified methods for information systems is very difficult and slow.

The conception of the further development of projects and programmes is in conformity with the requirements of the quantitative and qualitative development of automated systems of information and management. It is necessary to envisage combined measures through standardization for a rational utilization of basic and applied programmes with a view to assure the compatibility of data and programmes of the individual means of computer technology, as well as the unification of the basic programmes prepared in different CEMA member countries. Similar requirements are valid for automated systems of control of basic data. The users have to be oriented to the use of unified programmes so as to ensure that the conditions for the use of existing programmes be realized, the costs of the elaboration of new programmes is reduced, and the quality of the service is improved.

Taking into account effect of the existing standard solutions of projects and programmes, it can be expected that a similar progressive development will continue in the elaboration and realization of automated systems. It is probable that the economic, regulatory, financial, and organizational conditions for the improvement and extension of the forms of joint preparation of programmes and their exchange will be realized.

There are a relatively high number of projecting and programming specialists in Czechoslovakia. There are nearly 20,000 persons doing such work in the Office for Computer Technology and other organizations. Supported by the existing research base, they represent an important force, capable of assuring the development of automated systems also in the future. However, it would be advisable to unite their capacity in a rational manner, in specialized organizations or groups with limited fields of activities and well-defined tasks. In some cases, the international exchange of programmes shows that it would be appropriate to intensify international cooperation primarily in the development of basic programmes and standard programme modules for the main processes of planning and management for the different sectors of the economy and social life.

Boris Senyaninov and Georgi Babichev

Council for the Use of Computer Technology of the Intergovernmental Commission for Cooperation in Computer Technology

The multilateral cooperation of the CEMA member countries in the implementation of means of computer technology is carried out in the Intergovernmental Commission for Cooperation in Computer Technology, in accordance with the Intergovernmental Agreement of 23 December 1969. The coordinating body is the Council for the Use of Computer Technology, set up in 1977 on the basis of working groups on automated control systems and automated projecting systems.

The main objectives of the council are the realization of a uniform policy and the coordination of cooperation by the countries participating in the agreement in the use of computers for the effective utilization of the Unified Computer System and the System of Minicomputers in the economies of the cooperating countries.

The following activities were identified:

—elaboration of general systemic and methodological questions concerning implementation;

—development of software for the automation of projecting, automation of management of organizational economic and production systems, automation of the technological process of programming, and the training of staff.

Some ways were agreed upon for the planning of joint work, inspection of its fulfillment, and exchange of its results, involving coordination, meeting of specialists elaborating the individual items, as well as seminars. The results of scientific research and preparatory work for projects are submitted in the form of presentations. After the execution of joint experiments, the software is transferred to the Common Collection of Applied Programmes. All work carried out in the council is organized and financed by the participant states.

Over 140 organizations from 8 CEMA countries participate (from Bulgaria, Cuba, Czechoslovakia, the GDR, Hungary, Poland, Romania, and the Soviet Union). The organizations represented in the council are, as a rule, those responsible in their countries for the use of computers in the economy.

In the course of the most recent period, in accordance with the plans of multilateral cooperation, about 240 packages of applied programmes were developed, and about 160 scientific methodological works were carried out.

The packages of applied programmes, developed within the framework of the multilateral cooperation, are introduced in the individual countries with success. For example, the package of applied programmes Bastay (developed mainly in the GDR) operates with success in the First Moscow Watch Factory. The database control system Setor (the Soviet Union) is used by 20 organizations in Bulgaria. The implementation in 58 Soviet organizations of the package of applied programmes for the automation of applied geometry work saves 1.77 million roubles per year; that for the construction of presses for the cold moulding of discs assures yearly saving of 40,000 roubles in seven companies; that developed for the projecting of electrical schemes for the control of technological equipment saves about 90,000 roubles for the manufacturer, and the package of applied programmes for the design of gears (prepared in Bulgaria) economizes over 100,000 roubles in five companies.

In 1978-1980, the Central Scientific Research and Projecting Institute of the State Construction Committee elaborated, in accordance with the plans of the multilateral cooperation, three packages of applied programmes for the graphic presentation of results received on computers with the aid of plotters and screens. Those packages have been implemented in 30 organizations belonging to different ministries and authorities engaged in the preparation of projects of capital construction.

The Regional Scientific Research and Projecting Institute of Standard and Experimental Projects for Residential and Public Buildings of the State Committee for Civil Construction (the Soviet Union) uses with success the packages developed in conformity with the plans of international cooperation, for technological lines in the projecting of the constructional part of large panel buildings and iron shell type residential buildings.

The application of packages of applied programmes for automated management systems in organizations belonging to the Ministry of Precision Engineering and that of Agricultural Engineering (the Soviet Union) has saved several million roubles. The use of such packages for the automation of manual work in the post office, in the State Bank, and in savings banks of the GDR made the work of about 7,000 persons superfluous.

The results achieved with the elaboration of the subject "Improvement of the List of Professions for the Training of Staff in Computer Technology in Universities and Secondary Schools as Well as for Other Forms of Training Concerning Automated Projecting Systems, Automated Systems of Organizational Management, and Those for the Control of Technological Processes" were implemented in Bulgaria, Cuba, Czechoslovakia, the GDR, Hungary, and the Soviet Union. Based on them, recommendations concerning the content of training plans and programmes have been worked out and implemented.

Guides for the establishment of automated projecting systems, developed in accordance with the plan of international coordination, served as a basis for the preparation of the General Sectorial Guides for the Establishment of Automated Projecting Systems (the Soviet Union). The USSR State Committee for Science and Technology decided to recommend to ministries and other authorities the use of methodological instructions for the analysis of production resources in companies.

The volume of the mutual exchange of software for the technology of programming between Cuba, Hungary, and the Soviet Union amounted to 300,000 roubles. The methodological instruction for the establishment of automated systems for the control of technological processes served as a basis for the coordination of individual phases on the occasion of the conclusion of contracts and the identification of requirements concerning newly development systems. The methodological instructions were also used by the Soviet party in connection with carrying out work based on contracts of a total value of over 27 million roubles at 12 objects in Bulgaria, Czechoslovakia, and the GDR.

The experience of the organization and realization of joint work shows that there are unutilized reserves in the multilateral cooperation for the use of computers in the economy of the socialist countries.

One of them is the increase in the volume of the trade in software, which is limited at present to a small portion of existing software in those countries, and which does not cover the needs of the cooperating countries. This can be proved by the following facts. The volume of trade in computer hardware between those countries amounts to hundreds of millions of roubles. Trade in software as a means of production is not planned, it is of an occasional character, and consequently is a small proportion of mutual trade in computers.

It should be noted that in leading capitalist firms, the relation of expenses for software to those for the production and implementation of means of computer technology is 9:1. Software supplied by outside organizations amounts to 20 percent of the overall costs of software for universal systems and about 40 percent of those for small computers.

The main difficulties in the way of increasing the mutual trade in software are due to the absence of a proper economic mechanism assuring the possibilities of a rapid satisfaction by both the staff and the users in the cooperating countries of export and import needs in software imperfections in mutual information, and the long procedure of drafting and concluding contracts.

The resolution of the 41st (Extraordinary) CEMA Session meeting concerning the extension of the rights of the leading organizations and the improvement of organizational forms in the execution of common work will certainly contribute to the growth in the efficiency of cooperation.

The accelerated development of science and technology requires a rapid change of generations of computers, the continuous implementation of the latest types of means of computer technology and renewed training of staff.

The extension of cooperation in computer software should be directed to the deepening of specialization and cooperation in the development of software, the growth in the exchange of programmes in the interest of a more effective utilization of the scientific and technical capacities of the cooperating countries. It is necessary to widen cooperation in standardization and integration as they provide a basis for specialization and coproduction. Standardization is expected to assure compatibility and interchangeability of software at all phases, as well as a high technical level of joint development.

Specialization and cooperation should embrace the whole production cycle from scientific research coordination of investments and production programmes up to sales and the organization of after-sales services.

Practice also shows that the mutual obligations of the cooperating countries can be properly carried out if they are reflected in national economic plans.

In conformity with the resolutions of the Summit Economic Conference of the CEMA member countries and of the 41st (Extraordinary) CEMA Session meeting, the use of computers and automated systems in the individual countries and in the totality of the cooperating countries should be reflected in the plans for the electronization of the economy and the comprehensive automation of production. That method would assure a comprehensive approach and attain an integrated effect of automation covering both industrial and nonindustrial spheres. This requires the consideration of all phases of software development: scientific research and experimental construction work, the preparation of programmes through specialization and cooperation, the implementation of the best programmes in the economy, a follow-up of the programmes by new working technologies applicable as a consequence of the adoption of the programme.

One of the reserves making for a growth in the efficiency of cooperation is technical service. At present it is an object of the technical revolution, an important element of export capacity. Unfortunately, the organizations of international cooperation have not yet studied thoroughly the questions of the organization of sales and after-sale activities in relation to software, as well as planning of exports with due regard to the demand on domestic and foreign markets. The necessary attention to the realization and technical servicing was not assured; without it , the comprehensive approach cannot be attained and an integrated effect will not materialize. Experience and technical servicing should be considered as inseparable elements of investments.

The development of work in the Council for the Use of Computer Technology is directed to the improvement of the programme and organizational forms of the execution of joint activities and the exchange of software.

An Integrated Plan of Cooperation for the 1986-1990 period has been prepared with due account for: the economic priorities (electronization of the national economy and comprehensive automation); the Comprehensive Program of Scientific and Technical Progress of the CEMA Member Counties to the Year 2000; the programmes of general agreements on flexible production systems; automated projecting systems and microprocessor technology.

There are about 200 entries in the plan envisaging the elaboration of methodological and normative documents, as well as the development of software and projects of new generations of automated systems assuring an efficient use of means of computer technology, inter alia those for the transfer of data to the different sectors of the economy and, in particular, mechanical engineering. The plan also contains requirements concerning the standardization of software, the development and elaboration of standard technologies for the creation and industrial manufacturing of flexible production systems, and computers for export.

The contributions of participants at the round table conference bear witness to the important successes of the socialist countries in this field. The computer park grew apace, computers belonging to the Unified Computer System and to the System of Minicomputers are at its heart. Specialists are available and creative collectives participating in the elaboration and use of computer technology have been formed. In Czechoslovakia alone, over 20,000 persons are engaged in that field. The activities concerning the implementation of computer technology are included in the state plans. The structure of organization and the coordinating bodies have also been determined.

Computer technology is used in practically all sectors of the economy, primarily for the automation of production projecting, management, and training.

In parallel with the extension of the use of computers and the depths of the elaboration of the problems, specialists using that technology make, with an ever growing consistency and with well-founded arguments, demands concerning the type and configuration of computers and the reliability of hardware, as well as the quality and performance of software. Up to the present, industry mainly supplied universal computers. Today it is imperative to develop specialized processors, accessories, software and hardware, and methodologically specialized software complexes.

The cooperation of the socialist countries has a prominent role in the development and implementation of computer technology. Cooperation in the framework of the Council for the Use of Computer Technology gave an impetus to the improvement of different automation activities in the relevant countries. The participants at the round table conference noted that, at present with the deepening integration, inter alia through specialization and coproduction, the capacities of the countries, in particular those of the experts, their ability, knowledge, and experience, and those related to the development of software, should be united in order to assure an effective use of means of computer technology.

The importance of cooperation has particular significance at the present phase of development, in relation to the realization of the Comprehensive Programme of Scientific and Technical Progress of the CEMA Member Countries to the Year 2000, and in particular that of the agreement on cooperation and development on the basis of computers of automated jobs for different purposes, systems of automated projecting, flexible production systems, shared pools of algorythms and programmes, data bank control systems, and means of automation for programming.

Under such conditions, as was stressed by the experts, there is an urgent need for the improvement of the organizational forms of joint work. As to the software, the improvement should cover scientific research work, production, implementation, and follow-up.

The interest of the specialists of the socialist countries in the consideration of the relevant problems gives evidence of the existence of significant reserves in the development of the most important sectors of the economy and the necessity of uniting all kinds of those resources.

Cooperation in the development, production, and use of computers is a powerful lever for the acceleration of the scientific and technical progress of each individual socialist country and of their community as a whole. That lever should be operated in the most efficient way.

Statute on Committee for Computer Technology, Information Science

18140260 Moscow SOBRANIYE POSTANOVLENIY PRAVITELSTVA SOYUZA SOVETSKIKH SOTSIALISTICHESKIKH RESPUBLIK in Russian No 29, 1987 pp 595-603

[Decree No 456 of the USSR Council of Ministers on Ratification of the Statute on the USSR State Committee for Computer Technology and Information Science, 21 April 1987]

[Text] In connection with Decree No 361 of the CPSU Central Committee and the USSR Council of Ministers of 20 March 1986 "On Improving Coordination of Work in the Field of Computer Technology and on Raising the Efficiency of Its Use," the USSR Council of Ministers decrees:

1. To ratify the appended Statute on the USSR State Committee for Computer Technology and Information Science.

2. To recognize the decisions of the USSR Government on questions of computer technology as being no longer in force in accordance with the appended listing.

3. To ratify the appended changes which are inserted into the decisions of the USSR Government on questions of computer technology.

[Signed] Chairman of the USSR Council of Ministers N. Ryzhkov

Administrator of Affairs of the USSR Council of Ministers M. Smirtyukov

Moscow, the Kremlin. 21 April 1987. No 456.

Statute on the USSR State Committee for Computer Technology and Information Science

1. The USSR State Committee for Computer Technology and Information Sciences (GKVTI SSSR) is an all-union organ of state administration exercising supervision of development of work in this field for the purpose of ensuring acceleration of scientific and technical progress and raising efficiency of public production.

The USSR State Committee for Computer Technology and Information Science is assigned the responsibility for putting into practice a unified technical policy, the state, further development and coordination of work in the field of computer technology and information science, including work done within the framework of cooperation with CEMA member countries.

2. The chief tasks of the USSR State Committee for Computer Technology and Information Sciences are:

—radical upgrading of the technical levels of computer equipment, organizing jointly with ministries and departments production of this equipment (including software), improving its use in sectors of the national economy and organizing and improving work in the field of information science;

—determination of the basic directions of development of computer technology and information science while taking into account their priority, monitoring the fulfillment of decisions of the Party and the Government on questions relating to the development of computer technology and information science;

—ensuring the integrated development of the production and scientific-technical base of computer technology and information science in the country and solving intersectorial problems for the purpose of fullest possible satisfaction of the needs of the national economy for computer equipment and computer information services;

—further improvement of work organization in the field of computer equipment, coordination of work on the creation of component parts (including products of electronic technology) and special materials for computer equipment.

3. The USSR State Committee for Computer Technology and Information Sciences in conformity with the main tasks assigned to it carries out:

a) coordination and scientific methodological supervision of the development of special-goal programs for raising the efficiency of use of computer equipment and automated systems in the national economy and monitoring their fulfillment, preparation and approval of scientific methodological documentation for the creation of these programs and methodological supervision and coordination of the work of intersectorial scientific-technical complexes in the field of computer technology and information science;

b) approval on presentation by ministries and departments of integrated programs of basic research and scientific-research and experimental-design work in the field of computer technology and information science and together with the USSR State Committee for Standards of programs on standardization and unification of hardware and software of computer equipment as well as determination of criteria for evaluation of the technical level of created computer and information-science equipment and participation in certification of this equipment and in the development of corresponding projects of state standards;

c) analysis jointly with ministries and departments of the use of general-purpose computer and information-science equipment, accounting of this equipment and prediction of its need by the national economy;

d) preparation jointly with ministries and departments by manufacturers of general-purpose computer equipment, including software, and presentation in accordance with prescribed procedure of proposals for drafts of 5-year and annual plans for the production of this equipment as well as monitoring the fulfillment of these plans;

e) preparation jointly with ministries and departments by manufacturers of general-purpose computer equipment of proposals for allocation of capital investment for the development of a scientific-technical and production base for computer technology and information science;

f) preparation jointly with USSR ministries and departments and councils of ministers of union republics and presentation in accordance with prescribed procedure of proposals for drafts of 5-year and annual plans for use of computer equipment (including targets relating to economic effectiveness) and monitoring the fulfillment of these plans as well as preparation of proposals for upgrading effectiveness of use of computer equipment in the national economy;

g) preparation on the basis of proposals of USSR ministries and departments for creation of computer and information-science equipment and presentation in accordance with prescribed procedure of consolidated proposals for its inclusion in drafts of 5-year and annual state plans of USSR economic and social development;

h) preparation of proposals on specialization of ministries and departments for the development and production of computer equipment as well as on determination of head ministries and departments for the realization of comprehensive programs in the field of computer technology and information science;

i) development in the country of a network of scientific-research, planning, design and technological organizations in the field of computer technology and information science;

j) performance of the functions of general buyer of general-purpose computer equipment, computer systems and multiple-access information systems, regional computer networks (as part of technical supervision of work relating to their creation), including coordination with him of appropriate technical targets and technical conditions for computer and information-science equipment and special conditions of its delivery as well as approval of staffs of state commissions for acceptance of completed work;

k) comprehensive centralized servicing of computer equipment, punch-card and keyboard computers, typewriters and duplicating equipment put out by domestic industry or purchased abroad as well as computer complexes produced on the basis of this equipment;

l) systematic quality control of computer and information-science equipment in a manner agreed upon with the USSR State Committee for Standards;

m) distribution of general-purpose computer equipment (including that purchased in socialist countries), including spare parts for it and data storage devices intended for use in the national economy, issuing of orders for their delivery and also development and approval of balances and plans for distribution of this equipment;

n) carrying out and further development of work for the creation and improvement of software, introduction of industrial methods for its creation and organization and administration of a statewide system of production, accounting, storage and delivery of this equipment as products of production and technical designation;

o) development of capacities for production of software, manufacture of equipment for determination of a fixed amount of duplication, repair of computer equipment, production of data storage devices on a paper basis, manufacture of service (diagnostic) equipment and tools as well as equipment for the storage and transportation of data storage devices and other technological equipment;

p) production of general-purpose software and provision of services for its use;

q) carrying out and coordination of work in the field of information science, including that related to the creation of data and knowledge bases, and provision of data computer services;

r) supervision of work on the creation and operation in the country of computer (information and computer) centers and multiple-access computer centers irrespective of their departmental affiliation and examination of proposals on the creation of these centers irrespective of their departmental affiliation;

s) the making up of sets of general-purpose computer hardware and software in accordance with standard documentation as well as the full delivery of this equipment in accordance with documentation for different types of automated systems;

t) carrying out and coordination of work concerned with training and retraining of specialists in the field of computer technology and information science;

u) coordination of scientific and technical ties in the field of computer technology and information with foreign countries and international organizations;

v) coordination of work conducted in the country on ensuring the cooperation of CEMA member countries in the field of computer technology and information science and preparation of questions for the Soviet part of the Intergovernmental Commission for Cooperation of Socialist Countries in the Field of Computer Technology;

w) examination of orders of USSR ministries and departments and councils of ministers of union republics for purchasing abroad (regardless of sources for financing the purchase) of licenses, technical documentation and computer equipment, including software, as well as complete specialized equipment for the production of this equipment and issuing of conclusions on the suitability of such purchases;

x) coordination of work on creation of component parts, including electronic products and special materials for computer equipment;

y) creation in accordance with prescribed procedure of a reserve of material, financial and manpower resources of the Committee for the Organization and Carrying Out of New and Unforeseen Work in the Field of Computer Technology and Information Science.

4. The USSR State Committee for Computer Technology and Information Science is granted the right:

a) to monitor the fulfillment by ministries and departments and enterprises subordinated to them, institutions and organizations of decisions of the party and the government relating to questions of development, production and utilization of computer equipment;

b) to listen at meetings of the collegium to reports of representatives of ministries and departments and heads of enterprises, institutions and organizations on the course of fulfillment of plans for the creation and use of computer equipment and other questions within the competence of the Committee;

c) to receive from the USSR Central Statistical Administration statistical data and from ministries, departments, enterprises, institutions and organizations, irrespective of their departmental subordination, necessary materials on questions relating to competence of the Committee;

d) on agreement with heads of appropriate organizations, to include scientists and specialists of ministries and departments, enterprises, institutions and organizations in the development and examination of individual problems in the field of computer technology and information science and also for conducting consultations and expert examinations;

e) to form interdepartmental councils, commissions, expert councils and groups and to convoke in accordance with prescribed procedure conferences and gatherings on questions of computer technology and information science;

f) to create and implement all-union scientific and technical work programs on the most importance problems in the field of computer technology and information science;

g) to examine differences arising among ministries and departments on questions relating to the development of computer technology and information science;

h) to adopt decrees and regulations, to enact instructions, rules and methodological instructions on questions within the competence of the Committee that would be obligatory for all ministries, departments, enterprises, institutions and organizations;

i) to reward according to prescribed procedure the best workers within the Committee's system with badges worn on the chest and honorary certificates.

5. The USSR State Committee for Computer Technology and Information Science in accordance with prescribed procedure creates, reorganizes and closes enterprises, institutions and organizations and also enacts regulations (rules) relating to these enterprises, institutions and organizations.

The USSR State Committee for Computer Technology and Information Science and enterprises, institutions and organizations under its jurisdiction make up the Committee's system.

6. The USSR State Committee for Computer Technology and Information Science is guided in its work by USSR laws, other decisions of the USSR Supreme Soviet and its Presidium, decrees and regulations of the USSR Council of Ministers, the present Statute and other normative acts and also ensures the proper application of existing legislation to enterprises, institutions and organizations under the Committee's jurisdiction.

The USSR State Committee for Computer Technology and Information Science generalizes the practical work of of using legislation on questions within its competence, works out proposals for its improvement and submits them in accordance with prescribed procedure to the USSR Council of Ministers. It implements measures for the improvement of legal work at enterprises, institutions and organizations of the Committee's system.

7. The USSR State Committee for Computer Technology and Information Sciences in exercising the functions relating to ensuring the operation of jurisdictional enterprises, institutions and organizations in the field of planning, science and technology, capital construction, material and technical supply, finances and credit, personnel, labor and wages as well as in the sphere of economic, scientific-technical and cultural ties with foreign countries is guided by the General Statute on USSR Ministries.

8. The USSR State Committee for Computer Technology and Information Science is made up of the Chairman of the Committee appointed in conformity with the USSR Constitution by the USSR Supreme Soviet and in the period between sessions by the Presidium of the USSR Supreme Soviet with subsequent presentation for approval to the USSR Supreme Soviet, Deputy Chairmen appointed by the USSR Council of Ministers and Committee members from among leading scientists, managers of industry and personnel of the Committee's system.

At meetings of the Committee that are held as the need arises, but not less often than once a year, the most important problems are examined of implementation of a unified technical policy, improvement of coordination and development in the country of work in the sphere of creation and production of computer equipment, raising the efficiency of its use and the technical level, quality and reliability, and growth of work in the field of information science as well as ensuring retooling of sectors of the national economy and speeding up scientific and technical progress on the basis of use of computer technology and automated systems.

9. A collegium is formed at the USSR State Committee for Computer Technology and Information Science, consisting of the Chairman of the Committee (chairman of the collegium) and the Committee's Deputy Chairman for Work as well as other Committee members.

Assignment of duties among the Deputy Chairmen is done by the Chairman of the USSR Committee for Computer Technology and Information Science.

Members of the Committee's collegium are approved by the USSR Council of Ministers.

10. The Chairman of the USSR Committee for Computer Technology and Information Science bears personal responsibility for fulfillment of the tasks and duties assigned to the Committee, determines the degree of responsibility of Deputy Chairmen and managers of structural subdivisions of the Committee's central apparatus for supervision of individual fields of the Committee's work as well as of the work of enterprises, institutions and organizations of the Committee's system.

11. The Chairman of the USSR State Committee for Computer Technology and Information Science within the limits of the Committee's competence puts out orders and instructions and provides directives that have to be carried out by enterprises, institutions and organizations of the Committee's system and verifies their fulfillment.

The Chairman of the USSR State Committee for Computer Technology and Information Science in necessary cases issues with USSR ministers and heads of USSR departments joint orders and instructions.

12. The collegium of the USSR State Committee for Computer Technology and Information Science at its regularly held meetings examines the main questions of development of computer technology and information science and practical management of enterprises, institutions and organizations of the Committee's system, verification of fulfillment and strengthening of discipline, selection, training, use and upgrading of qualifications of personnel. It discusses drafts of normative and other important documents submitted for examination by higher organs, very important orders and instructions, listens to addresses and reports of structural subdivisions of the Committee's Central apparatus as well as of subordinate enterprises, institutions and organizations.

Decisions of the collegium are implemented as a rule through orders of the Committee's Chairman.

In the event of disagreements between the Committee's Chairman and the collegium, the Chairman implements his decision, reporting on the occurred disagreements to the USSR Council of Ministers, while members of the collegium in their turn may communicate their opinion to the USSR Council of Ministers.

13. For preparation of proposals on very important problems in the field of computer technology and information science, a scientific council and technical council is created at the USSR State Committee for Computer Technology and Information Science, including in its membership general and chief designers of computer equipment and automated systems as well as leading specialists and prominent scientists in the field of computer technology and information science, innovators in production and representatives of scientific and technical societies and other organizations.

The membership of the scientific and technical council and the regulation concerning it are approved by the Committee's Chairman.

14. The USSR State Committee for Computer Technology and Information Science serves as arbitrator in examination of economic disputes among enterprises, institutions and organizations of the Committee's system.

15. The structure and number of personnel of the central apparatus of the USSR State Committee for Computer Technology and Information Science are approved by the USSR Council of Ministers.

The staff of the Committee's central apparatus and the regulation concerning its structural subdivisions are approved by the Committee's Chairman.

16. The USSR State Committee for Computer Technology and Information Science has a stamp with representation of the USSR State Seal and its name.

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Problems of Introducing Microelectronic Inventions

18140090 Minsk SOVETSKAYA BELORUSSIYA in Russian 24 Oct 87 p 2

[Interview with Corresponding Member of the Belorussian SSR Academy of Sciences Anatoliy Pavlovich Dostanko, prorector of the Minsk Radio Engineering Institute, doctor of technical sciences, professor, Honored Figure of Science and Technology of the Belorussian SSR, Honored Inventor of the USSR, and winner of the Belorussian SSR State Prize, by *Sovetskaya Belorussiya* correspondent V. Bibikov under the rubric "A Competent Collocutor": " 'Who, If Not the Author?...' "; date, place, and occasion not given; first paragraph is *Sovetskaya Belorussiya* introduction]

[Text] The names of President of the Ukrainian Academy of Sciences B.Ye. Paton, director of the Moscow Scientific Research Institute of Eye Microsurgery S.N. Fedorov, and Professor G.A. Ilizarov of Kurgan, the developer of original devices for the treatment of bone fractures, are, perhaps, no less well known today than the names of popular movie actors. The honorary title of Honored Inventor of the USSR was conferred on them for the development of technical innovations of great importance. Until recently only seven people were its holders. As the eighth (and the first in our republic, as well as in the field of microelectronics) the Presidium of the USSR Supreme Soviet awarded this title to Corresponding Member of the Belorussian SSR Academy of Sciences A.P. Dostanko, prorector of the Minsk Radio Engineering Institute, doctor of technical sciences, professor, Honored Figure of Science and Technology of the Belorussian SSR, and winner of the Belorussian SSR State Prize. Here is an interview of a *Sovetskaya Belorussiya* correspondent with him.

[Question] Anatoliy Pavlovich, you are the author of more than 170 inventions. The labor of people, who are enthusiastic about creative research, is comprehensible to you as it is to no one else. Without them scientific and technical progress is impossible....

[Answer] In order to underscore the importance of creative inventing work, I will sight the following example from a field close to me. In Japan a very large-scale integrated circuit with a memory capacity of 16 megabytes was developed. This is equivalent to the information presented on 1,190 typed pages. Moreover, only 87 billionths of a second are spent on the retrieval and output of the necessary recording area. The circuit itself is a silicon chip measuring 8.9 by 16.6 millimeters and 0.3 millimeter thick, which consists of more than 20 layers of semiconductor, metals, and oxides, millions of sections of which form a common conducting system. Such a design is equivalent to an electronic circuit that contains 40 million traditional transistors, resistors, and other elements.

It is difficult to mentally imagine this system, it is even more difficult to develop and produce it. Up to 10 million coordinates are used for the designing of such an integrated circuit—nearly as many as in case of the development of the Belarus tractor, the SK-4 combine, the BelAZ heavy truck, and the Antey airplane, taken together.

[Question] Many of your inventions, I know, have been embodied in new advanced technologies. Could you tell me about the greatest success?

[Answer] I regard as one of my most important successes the development of integrated ion-beam technology and modular equipment for the production of very large-scale integrated circuits. The opportunity appeared to obtain such combinations of conducting layers, which just recently seemed fantastic. This broadened drastically the possibilities of technology and improved the quality of items. Such know-how thus far does not exist abroad.

[Question] In one of his speeches M.S. Gorbachev called microelectronics a catalyst of scientific and technical progress. However, the household electric equipment and computer hardware, which are being produced, for their most part, unfortunately, are inferior to the best foreign models. What, in our opinion, is the matter here?

[Answer] I would like to note at once that domestic scientific and technical developments, including ones that originated in laboratories of the Academy of Sciences, higher educational institutions, and industrial enterprises of our republic, often are not inferior to the best foreign achievements, and in a number of cases surpass them. However, industry is not always willing to use new solutions. And economically it is easier for enterprises to fulfill the plan indicators on old products. Although in word everyone agrees that the closest attention should be devoted to advanced innovations, for without them it is impossible to produce items of the world level.

On the other hand, both the very authors of new ideas and those, who deal with their introduction in practice, materially are little interested in this work. For example, a scientist formulated a new theory or principle, which was embodied in technical inventions, which made it possible to develop a new material, technology, machine, and so on. But, not being the immediate author of the invention, as a reward he will not receive a kopeck, although his labor contribution is obvious.

And the author of an invention can lay claim to a reward only during the first 5 years of use of an innovation. However, this is precisely the period, when the assimilation of new production takes place and the economic impact is minimal. But a writer or artist receives royalties regardless of when he created the work. How is an

inventor worse? As a result thus far neither the collectives of enterprises nor individual workers, unfortunately, are directly interested in the introduction of new equipment and technology. Although there is much talk about the need to change the situation.

[Question] If possible, several typical examples....

[Answer] Examples? There are many of them. Thus, we developed a television optical electronic pyrometric system, which makes it possible to measure without contact a temperature of up to 2000 degrees Celsius, to analyze its distribution through the object being heated directly in the technological cycle, to store this information, and by means of it to control the technology efficiently. It conforms to the best world models, is protected by 14 inventor's certificates and 4 patents, and has shown great efficiency at enterprises of Minsk, Moscow, and Leningrad. But...thus far it is not being series produced.

Technologies and equipment based on infrared radiation for the heat treatment of items have been used for more than 7 years at two enterprises of our republic. The impact is millions of rubles. But related enterprises of the sector as before are producing similar output on obsolete unproductive equipment. It is possible to continue the list.

But foreign competitors are not dozing. While working with patent literature and while at international exhibitions, I have more than once discovered a scientific or technical idea, which originated in our country, but was embodied in a somewhat disguised form abroad. In other words, western firms at times dress our scientific results in fine clothing and for this exact a dear price from us in currency. At the same time the West is carefully concealing from us its own latest achievements in the field of microelectronics.

[Question] How is one to improve the situation?

[Answer] The establishment of temporary creative brigades for the introduction of specific developments, in my opinion, is one of the ways of solving the problem. Representatives of science and the industrial enterprises, which carry out introduction, moreover, not only engineers and workers, but also managers of services and subdivisions, economists, and so on should be included in them. The material stimulation of the participants in the collective should be carried out subject to the obtained economic impact. While as a moral incentive, in my opinion, the new protective document "The Author's Certificate on Introduction," in which the enterprises, which introduced a specific development, its authors, the obtained impact, as well as the technological indicators of the use of the innovation will be indicated, should be introduced.

It is also time to think about establishing a republic firm for the introduction of scientific and technical achievements in production. Valuable experience in this area has been gained, for example, in Hungary, and it also exists in our country. It is very important to achieve such a situation, so that scientists of the Belorussian SSR Ministry of Higher and Secondary Specialized Education, the Belorussian SSR Academy of Sciences, and industry would work in one "team." Only then is it possible to achieve high end results....

[Question] In this way we will register as inventors all managers and workers, not to mention engineers and scientific associates. But such a thing is impossible.

[Answer] It is not necessary to register everyone, half, so to speak, would suffice. But we are also still very far from this level. For example, from 1981 to 1985, 18.4 million efficiency proposals were used in the USSR. Taking into account that in the All-Union Society of Inventors and Efficiency Experts today there are 14 million members, it turns out that in a year 1 member of the All-Union Society for Inventors and Efficiency Experts introduces only 0.3 efficiency proposal. In 1982 the 50,000 members of quality circles of the Japanese Toyota concern submitted nearly 2 million proposals and nearly all of them were used. There were 35 proposals per circle member, a hundredfold more than in our country. That is what is behind the high quality of Japanese items. In order to attain the same level, it is necessary to develop without delay an effective system of the utmost encouragement of people who are inquisitive, active, and not indifferent.

[Question] But desire alone is not enough to create a new thing. Knowledge and aptitude are needed. But, once again, not everyone has this.

[Answer] However paradoxical this will seem, it is possible to teach creativity. Since 1976 the school of the young inventor, at which the theory of solving inventing problems is studied, has been operating at our institute. The youth inventing school, the lessons of which our graduates conduct, is operating for the 2d year in Minsk under the aegis of the city Komsomol committee. Experience shows that with sufficient patience every young specialist, undergraduate, and even school child can learn invention. Now more than 200 undergraduates of our institute are inventors. The problem, I repeat, is that at many industrial enterprises "there is no demand" for innovators.

[Question] What would you wish your colleague inventors?

[Answer] First of all, boldness in the posing of problems and patience in case of the introduction of new ideas. It is necessary to be prepared for the failure to understand, for a new thing always makes its way in the world with difficulty. Perhaps, this is a kind of sociopsychological law. But who, if not the authors of new ideas, should in the end refute it?

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Patent Service Participation in Economic Restructuring

18140037a Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 6, Jun 87 pp 38-39

Article by Ya.I. Shumov, Patents and Licensing Department head, PKBplastmash (not further identified)]

[The April (1985) Central Committee Plenum and the 27th CPSU Congress established a fundamentally new approach to solving the country's social and economic problems. The CPSU considers the primary condition for successfully solving these problems today to be the acceleration of scientific-technical progress, as the leading factor in intensifying the economy, in labor productivity and efficiency growth. In light of these demands, the development of scientific-technical creativity and the accelerated use in production of the latest achievements, the most effective inventions and most meaningful efficiency proposals and the experience of innovators take on exceptionally important significance. However, the reference now must be not only to increasing invention but also, and foremost, to developing the export base, to substantial improvement in the competitiveness of plans, designs, technological developments and products, so as to maximize hard currency expenditures on the acquisition of imported equipment and technology. The machinery, instruments, equipment, technologies and materials developed must be targets of international cooperation and cooperation, foremost with CEMA countries, both on a licensing basis and on the basis of "know-how," "Engineering" and other forms of realization.

Patent-licensing, invention and efficiency improvement work must thus be one of the most important aspects of enterprise (association) activity. Practical realization of all the above-indicated tasks must also be a basic duty of the patents service.

More than a year and a half has passed since publication of the "Standard Regulation on the Patents-Licensing, Invention and Efficiency Improvement Subdivisions of Enterprises, Organizations and Institutions," an important standards document from the USSR State Committee for Inventions and Discoveries. This document unambiguously establishes the validity of the existence of such subdivisions as basic, independent organization subdivisions directly subordinate to the organization's leader, which has facilitated eliminating various misunderstandings about the role and importance of those services in the present stage of improvement of the economic mechanism. However, the practical experience of those subdivisions testifies to the fact that many executives at various levels continue, either because of sluggish thinking or because they underestimate the importance of the patents service, to give it a secondary role, in some instances even ordering their cross-subordination.

Neither the structure nor the size of the patents subdivisions have changed hardly at all; their actual place among other enterprise subdivisions remains "functional." Even when operating under the new wage conditions, there is a disparity between material incentives for workers in these subdivisions and those for other workers. It is for precisely these reasons that it is not considered prestigious for skilled specialists to move to the patents subdivisions and such moves are not materially encouraged. It becomes a closed circle: the subdivision, denied an opportunity to actively influence enterprise scientific-technical policy by the weight of past experience, is always forced to march not in front of the developers, but behind them and, like someone "running for a train," it cannot be a basic, leading link, with all the consequences stemming from that. Of course, the prestige and importance of the patents service depends to a not inconsiderable degree on the skill, initiative and enthusiasm of its workers and on a number of other conditions. No executive would say these days that "we don't need this service," since that would conflict with the directives and standards instructions. In addition, it is simply "unfashionable," as quantitative indicators of the activity of this subdivision always figure in all the organization reports passed up to superiors as convincing arguments about the innovativeness of the developments, about their conformity to world scientific-technical levels and about their economic effectiveness. The above is also confirmed by materials from an analysis of branch invention and efficiency-improvement activity and the problems of organizing practical patents service activity on a branch scale.(1)

Issues of perfecting the work of these services received further concretization in the draft USSR Law "On the State Enterprise (Association)." Thus, Point 7 of Article 11 of the law notes that "the enterprise strives to involve all members of the labor collective in resolving the tasks of accelerating scientific-technical progress..., encouraging the scientific-technical creativity of the laborers in every way possible." However, with reference to this point, and with specific regard to patents and licensing activity, the primary stress should be on ensuring the protection of patent and licensing information. One would think this enterprise function would be inseparably connected with another, equally important, function, that of creating the most optimum conditions possible for the rapid, qualitative use of scientific and technical achievements, both for the purposes of intensifying production and for the purposes of developing the export base. The following change is therefore proposed to the second sentence in Point 7 of Article 11 of the draft law: "It organizes and effects patenting-licensing activity, invention and efficiency-improvement work, exchange of experience and public reviews; it creates quality control groups and uses other forms of creative laborer

participation aimed at raising the technical level and improving the competitiveness and quality of scientific-research, planning and design and that of the resulting output; it ensures the protection of technological, patent and licensing information and sets up its operational use both to intensify production and to expand exports, for exchanging the latest scientific-technical achievements through licensing and in other ways, and to organize international production specialization and cooperation, foremost with CEMA countries."

It is precisely this broader interpretation of the functions of the enterprise (association) which permits not only the legal validation, but also the factual validation, of the actual role of the patent services in the enterprise (association) system, focusing their activity on the resolution of pressing tasks and on practical assistance in organizing and establishing these subdivisions.

Footnotes:

G.F., "Increasing the Role of Invention and Efficiency Improvement in the Ministry of Chemical Machine-Building," in VOPROSY IZOBRETATELSTVA, No 11, 1985, pp 8-12.

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System for Registering Discoveries
18140152 Moscow PRAVDA in Russian 15 Dec 87 p 3

[Letter from Academicians V. Magnitskiy, O. Reutov, G. Cherniy; correspondent members, USSR Academy of Science O. Lupanov, L. Rykunov, V. Skulachev; Professors V. Braginskiy, N. Brandt, M. Gusev, I. Zenin, B. Kudryashov, Yu. Kuzyakov, L. Levshin, I. Teplov, A. Cherepashchuk: "A Discovery is Claimed"]

[Text]**Back in 1947, at the initiative of famous scientists, including S. I. Vavilov, president of the USSR Academy of Scientists, the world's first system for the state registration of discoveries and protecting discoverer's rights was introduced in our country. Its practical use started in 1957.**

The task was not easy. Scientific ideas announced as scientific discoveries had to be reviewed and approved to see if they had not been made someplace in the world. This requires especially careful expertise, using the most prominent specialists in a given field. State and discoverers' priority in the discovery of new laws or of phenomena of nature had to be established. There had to be a reexamination of moral and material incentives to discoverers and, finally, assistance in using these achievements in science and technology, especially when they are the basis for important and efficient inventions. Discoveries are the summits of scientific exploration, from which one can see things which were previously unknown. Not many scientific collectives, to say nothing of individual scientists, succeed in reaching such heights. However, in the past 30 years more than 350 scientific discoveries, worthy additions to the country's intellectual wealth, have been approved and registered in the State Register. Life itself is evidence that the system for state registration of scientific discoveries and for protecting the discoverers' rights has proven itself.

However, some scientists (and even today they write this about the USSR State Committee for Inventions and Discoveries) feel that there is no need for this system. They say that it is sufficient to publish the essentials of a discovery. The discoveries' priority will thus be automatically won. But, is this true? The self-evaluation of a supposed discovery will not always be objective. There are prolonged and often fruitless discussions its reliability, or even the discoverers' priority. Finally, the struggle with publication isn't very easy, especially if it distrubs existing scientific conventional wisdom or the article is from somebody without high scientific recognition. The recognition of a discovery by an individual or even a group of scientists is far from state recognition based upon a thorough and careful review by experts.

It is noteworthy that in 1967 an international convention established the World Intellectual Property Organization. It includes scientific discoveries as an independent object of rights together with authors' rights over literary works, works of art, inventions, etc.

Advocates for protection only through publication refer to "divergence" between socialist and capitalist countries when it comes to defining a scientific discovery. However, there is "divergence" in many problems, above all in fundamental questions of world view. In such cases must we reject our own views, positions and even points of law?

In socialist countries the concepts "invention" and "discovery" are strictly differentiated. An "invention" is a technical solution to a task, which results in the creation of new, more effective, devices, methods and materials. A discovery, on the other hand, reveals previously unknown laws, phenomena and properties of nature (the material world). Its basic features are: It is the first time it has been found any place in the world, provability and its basic nature.

In the capitalist countries there is no legal protection for scientific discoveries, especially for those which are not immediately embodied in production and which do not earn quick profits. Businessmen are not interested in such scientific achievements. If an effective invention is based upon a discovery, the two concepts are simply merged. The U.S. Patent Laws state: "The terms 'invention' means an invention or discovery... Anyone who invents or discovers a useful method for manufacturing a product, machine, combination of materials or any

new or useful way of improving these can obtain a patent." Based upon this legal point, Bell Telephone obtained a patent for the discovery of the "Transistor Effect" (U.S.) and the "Diffusion Effect" (U.S., England), Sony obtained one for the "Tunnel Effect" and others.

The World Intellectual Property Organization is involved with problems in bringing order into the world wide legal protection of scientific discoveries. One must assume that the socialist countries' experience will be taken into account.

Our system for protecting this type of intellectual property must be improved and made more democratic and transparent. It cannot be considered normal for claims about a discovery to be examined behind closed doors at scientific organizations, frequently in thew Academy. Not only are the claimants not heard, but they are not even allowed to participate in the discussions. Such a disrespectful attitude towards the discoverers is not only impermissible, but is also harmful to the integrity of the reviewers and destroys faith in their objectivity and competence. The discovers must participate in the expert review of scientific discoveries. This should be reflected in the Law on discoveries and inventions now being prepared.

Also, in our opinion it is advisable to take stock of the state registration of new fundamental theories, ideas and hypotheses. After all, these are also part of the country's treasure house of intellectual wealth. It is important to fix priority for them.

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New Inventions Produce Economic Effect

18140061 Moscow NTR: PROBLEMY I RESHENIYA in Russian No 19, 6-19 Oct 87 p 2

[Article: "The USSR State Committee for Inventions and Discoveries Recommends"]

[Text] In issue No 17, 1987 of our bulletin, it was reported that the USSR State Committee for Inventions and Discoveries approved the most effective inventions and recommended their wide-scale use in sectors of the national economy. We acquainted readers with two of them: the power element and the automatic unit for drilling deep and superdeep wells. Today publications on the latest contributions of Soviet inventive thought are continuing.

A new technology of mechanical cleaning and finishing metal surfaces—needle milling [iglofrezerovaniye]—is bound to find extremely wide application in different sectors of industry. It was worked out at the All-Union Scientific-Research Institute for Construction of Main Petroleum Pipelines of the USSR Ministry of Construction of Petroleum and Gas Industry Enterprises (inventor's certificates 365089, 486521, and others).

Needle milling eliminates such labor-intensive, expensive and harmful to health processes as chemical pickling, shot-blast and fire dressing. It provides the possibility of mechanizing and automating processes of treating surfaces of metal and finished products and significantly boosts productivity, assuring high tool durability.

The technical solutions on whose basis the production process and equipment are created were defended by 30 author's certificates and have been patented abroad. Five licenses were sold for the process and the needle milling tool.

The annual economic effect from the use of only one needle milling device will vary from 10,000 to 100,000 rubles.

Enterprises of the USSR Ministry of Automotive Industry and the USSR Ministry of Civil Aviation, the USSR Ministry of Aviation Industry, Gosagroprom and others can use the working fluid for AMG-10B hydraulic systems (inventor's certificate No 644234), proposed by the State Scientific-Research Institute of Civil Aviation.

As shown by experimental tests, the new modification of the fluid compared to the series-produced one, increases the working cycle of a hydraulic system fourfold and ensures its reliability in temperature changes from -150 degrees to +150 degrees Celsius. The fluid is resistant to heat oxidation and mechanical action.

According to preliminary estimates, the need for it amounts to 10,000 to 20,000 tons a year.

The expected economic effect should be about 8 million rubles.

For servicing motor vehicles—pumping up tires, jet blowing and touching up damaged surfaces, the Temp-1 motor-vehicle compressor (inventor's certificate. No 116729), created at the Zavod imeni M.I. Kalinin Production Association, has been designated.

Compared to Soviet and foreign comparable devices, the new instrument is more productive (2.5 kilograms per square centimeter). The kit for Temp-1 provides spare units, which will help boost the longevity of the compressor and its universality. The instrument is compact, reliable and convenient to use.

Because of simplicity of design and reduced labor intensiveness of its manufacture, its price has dropped substantially: instead of the former 64 rubles, it now costs only 39 rubles.

Temp-1 comes under the category of new products of improved quality and is produced with the N index in small batches, 20,000 units a year.

The approximate requirement of the national economy is 1 million units.

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Uniform Protection of Joint Discoveries within CEMA Stressed

Moscow KHOZYAYSTVO I PRAVO in Russian No 7, Jul 87 pp 77-79

[Article by A. Komissarov, senior scientific associate, Poisk Scientific-Production Association: "CEMA. Improvement of Legal Protection of Joint Discoveries"]

[Text] The Comprehensive Program of Scientific and Technical Progress of CEMA Member Countries to the Year 2000 specifies a broad and comprehensive use of the possibilities of cooperation for all problems connected with ensuring progressive development of the scientific and technical potential. At the present time, approximately 3,000 scientific and technical organizations of CEMA member countries participate in cooperation. Each year, about 2,000 scientific-research works are completed and 200-300 new or improved designs, intruments or pieces of equipment are created and 100-150 production processes and 100-120 new types of materials and preparations are developed.[1]

A basic feature of the program is that it proposes to work up basic ideas into creation of advanced technologies, to develop new highly efficient machines and materials and to bolster the integrated character of cooperation in all the parts of the cycle "science—technology—production—sale." A special role is assigned in this to conducting joint basic research at international centers and academies of sciences of CEMA member countries.

It appears that the necessary social and economic and other prerequisites have been created for the solution of this important problem. The countries of the socialist community possess a sufficiently strong scientific and technical potential. It is enough to say that they have at their disposal roughly one-third of all scientific personnel.

The constantly growing complexity and depth of modern scientific research calls for unification of efforts not only of individual scientific institutions, not only of the various sectors of industry but also of specialists from different countries. As shown by the experience of the socialist states, such an integration of efforts will make it easier in the future to secure practical benefits from the results of basic research (work). Such a mechanism of cooperation serves as the basis of the Comprehensive Program of Scientific and Technical Progress of CEMA Member Countries to the Year 2000.

In this connection, the question of improving legal regulation of discoveries and the rapprochement and unification of the national legislation of CEMA member countries acquire special pressing importance.

A brief historical excursion shows that with deepening of scientific and technical cooperation within the CEMA framework, pertinent prerequisites and favorable conditions are created for developing through joint efforts basic theses and concepts relating to the legal regulation of relationships arising in connection with discoveries and inventions.

Thus the conception of "discoveries" was formulated, a procedure was refined of establishing a priority date and the rights of authors of discoveries were defined.

During 1986-1970 [sic], CEMA member countries undertook the coordination of the most important scientific and technical research on the basis of a consolidated plan.

Even in those years, there were acute questions of protecting joint discoveries, paying compensation to their authors, putting rights for such discoveries into effect in third countries and so on. For the purpose of regulating these questions, "Recommendations on Certain Questions Relating to Invention Connected with Conducting Scientific and Technical Research," were worked out. These were approved that same year at the 10th Session of the CEMA Executive Committee.

In accordance with the Recommendations, those discoveries are considered joint which are created jointly by citizens of two or several CEMA member countries with joint carrying out of the work. Discoveries made at joint scientific-research organizations are considered joint regardless of whether they are created by citizens of one or several countries.

Inasmuch as legal protection of discoveries so far does not exist in all countries, questions that arise are resolved by means of bilateral agreements between interested CEMA member countries.

In accordance with the mentioned Recommendations, the following procedure was established for the protection of joint discoveries (for CEMA member countries where such protection has been introduced—USSR, Czechoslovakia, Bulgaria, Mongolia and the Republic of Cuba), which it is useful to take into consideration when developing appropriate agreements on the legal protection of discveries of countries of the socialist community:

(1) protection is granted to joint discoveries made on the territory of these countries as well as to discoveries in which at least one of the collaborators is a citizen of the country providing protection to the discoveries. The application for issuing a certificate for the joint discovery is submitted once to the department of the country determined on the basis of decisions of the organizations whose staff members are the authors (coauthors) of the document;

(2) The applications for joint discoveries made at joint scientific-research organizations are submitted as a rule to a department of the countries of the organization's location. They are submitted and examined in conformity with the national legislation of each country. The certificate for such a discovery indicates the citizenship of the coauthors or the name of the joint scientific-research organization.

As we know, questions of regulation of the legal protection of scientific discoveries at the Joint Institute of Nuclear Research (Dubna) found their reflection in a special Statute which was developed by the institute's patent-study experts and approved by the Committee of Plenipotentiary Representatives of the Governments of Member Countries of the institute in 1973. Without going into a detailed analysis of the rules of this Statute, I would like to stress the importance of this type of document in the accomplishment of work connected with the determination, drawing up and ensuring of the rights of scientific workers for the end results obtained within the framework of scientific-research work.

It would seem that for purposes of regulating the adoption of such documents as well as unifying the contents and range of settlement of questions, it would be sensible to work out a Model Statute on Disclosure, Drawing up and Legal Protection of Discoveries Made in Cooperation Within the Framework of International Centers and Other Organizations. There is no doubt that the said document would be of a comprehensive character and encompass a broader range of questions since the approach to regulation of relationships in the considered field as a rule gives rise to the necessity of working out additional documents.

The question of property and nonproperty rights to a discovery whose coauthors are not only Soviet but also foreign citizens is decided by the USSR State Committee for Inventions and Discoveries in accordance with paragraph 7 of the Statute on Discoveries and Rationalization Proposals of 1972 providing that foreign citizens who are authors of discoveries and their heirs enjoy the rights provided by the present Statute and other acts of the USSR and union republics on a level with Soviet citizens if the discovery was made jointly with Soviet citizens or in performance of work at an enterprise, organization or institution located on the territory of the USSR. Soviet legislation in essence has adopted the rights of Article 5 (4) of the Model Statute on Discoveries of 1974 approved at the 7th session of the Conference of Heads of Departments Concerned with Inventions of CEMA Member Countries. This provides grounds for assuming that USSR legislation in principle is adapted for regulation of relationships arising in connection with protection of joint discoveries.

With improvement of the national legislation of CEMA member countries in the field of discoveries, it would be practicable to proceed from a consideration of two basic tasks:

(1) to develop such concepts and norms which, while taking into account the present level of science, would provide equitable legal protection for scientific discoveries in socialist society, would stimulate in every possible way creative scientific activity, strengthen the priority of the socialist state in achievements of science and provide on the basis of reciprocal conditions for the protection of rights to discoveries by foreign citizens;

(2) to ensure the convergence of normative concepts and categories in the field of protection of discoveries, submission of pertinent changes and refinements in legislation for the purpose of creating favorable conditions for standardization of legislative acts of CEMA member countries pertaining to legal protection of discoveries.

I believe that the basic purpose of the large amount of complex work for the long-term in the field of protection of discoveries in CEMA member countries should be the development of a draft of an Agreement on Issue of a Single Certificate for A Discovery in CEMA Member Countries (or a legal document of comparable type) operative on the territory of all the countries of the socialist community.

At the present time, improvement of the Model Statute on Discoveries of CEMA Member Countries of 1974 is connected with the need of further refinement and rapprochement of the national legislation of these countries on the following basic questions of legal protection of discoveries:

(1) the idea of a discovery that can be protected is in need of certain concretization in regard to more precise disclosure of the criteria for this determination (innovation, radical differences, authenticity);

(2) a concrete list of discoveries that can be protected is needed. At this stage, unity of the national legislations of CEMA member countries where the institution of legal protection of discoveries exists is established only with regard to geographic, geological, archeological and paleontological scientific positions and discoveries in the field of the social sciences;

(3) A mutually acceptable understanding is needed of the innovation and priority of a discovery.

A requirement of world innovation should be made on a scientific position claiming to be a discovery. But at the present time this question is dealt with differently: uniformity is lacking, for example, in regard to the procedure of determining sources discrediting the innovation of a discovery.

Among the sources discrediting the innovation of a discovery described in the application there are included positions expressed in one or another objective form (article in a journal, theses of a report and so on) accessible for perception by other people. In distinction

to inventions, the innovation of a discovery can be determined not by the date of submission of an application but by the date of the priority on the condition of its documentary confirmation;

(4) it would be useful to reach an agreement on bringing norms closer on sizes and times of payment of remuneration for discoveries.

It seems that at the first stage of realization of the Comprehensive Program of Scientific and Technical Progress a single certificate for a discovery may be issued together with a national protection document. It would be useful to envisage the possibility of issuing a single certificate first and foremost for the most important (fundamental) discoveries. As for other discoveries of importance primarily to individual participating countries, they can be protected by national certificates.

The procedure of selecting proposed discoveries for submission on their applications for a single certificate could be done initially by national departments concerned with inventions.

The successful realization of the above-mentioned norm will clearly largely depend on the effectiveness of the norms of national legislation. For the purpose of solving these questions, it would be practicable to increase the responsibility of institutions and organizations for the submission of an application.

Single registration of discoveries of socialist countries for the purpose of information and subsequent use of these achievements could be done by the International Center of Scientific and Technical Information—an international organization created in 1969 on the basis of an Agreement concluded between the governments of CEMA member countries on representation of national departments for invention.

Information on registered international discoveries (formula and description of a discovery, its practical and scientific value, brief data on the authors and scientific-research institutions where the discoveries were made) in our opinion could be advantageously formulated in a declaration and published in an official bulletin.

The right of authorship could be certified by a uniform certificate for a discovery issued by a specially designated department (situated at the department for invention) of an academy of sciences located in one of the CEMA member countries. It would be desirable to provide for the payment of a one-time incentive remuneration to the author (coauthors) of the discovery from deductions coming from the sale of the bulletin or a single fund formed at the designated department from receipts from CEMA member countries (see the Statute on the International Center of Scientific and Technical Information. Moscow, 1969).

The protection of discoveries by a single certificate of the socialist countries does not mean the establishment of an exclusive right to these achievements. Registered discoveries can be used without compensation and without any kind of permission by any organizations or citizens of these countries.

The single certificate ensures protection only of the authorship and priority of the given person (persons) and the achievements recognized as a discovery.

The authors of discoveries receiving such a document should be issued a special honorary certificate on the basis of a Statute worked out for these purposes.

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Intersectorial Standards, Production Quality

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[Article by Candidate of Technical Sciences V.V. Tkachenko under the rubric "Universal Education in Quality": "Lecture 7. Theme 4.4. Intersectorial Systems of Standards and Their Role in the Increase of Product Quality"[1]]

[Text]

The System of the Development and Delivery of Products to Production

For the purpose of establishing the necessary order and increasing the responsibility of the developers, producers, and users of products in the matter of developing and delivering new items to production, the CPSU Central Committee and the USSR Council of Ministers on 16 November 1970 by the decree "On the Increase of the Role of Standards in the Improvement of the Quality of the Output Being Produced" commissioned the USSR State Committee for Standards jointly with ministries, departments, and the councils of ministers of the union republics to draft sets of standards, which define the System of the Development and Delivery of Products to Production (SRPP).

The first basic standard of the system—All-Union State Standard 15.001-73—was approved in April 1973. This document established the general procedure of the drafting, coordination, and approval of technical assignments and the conducting of an evaluation of the technical specifications, tests of prototypes (test batches), and check tests of series-produced and mass-produced products and custom-made products, as well as the procedure of the issuing of permits for the delivery to production of new and modernized industrial products.

In recent years the USSR State Committee for Standards with the extensive participation of industry has analyzed the procedure of the delivery of items to production and on the basis of the gained experience has formulated new means of its improvement, including its simplification. Thus, on the basis of the fact that many ministries by their own sectorial standards had complicated unjustifiably (as compared with state standards) the procedure of the development of a new product (additional consultations, the multistage nature of the passage of a draft of a document, the drawing up of all kinds of reports, notices, and so on), the USSR State Committee for Standards in 1985 repealed all the sectorial and republic standards, which had been drawn up on the basis of the state standards of the System of the Development and Delivery of Products to Production. As a result of which the state standards of this system became the only documents, which are necessary for the development and delivery of items to production.

One should specially emphasize the following provision of the System of the Development and Delivery of Products to Production: all products, which are liable to development and delivery to production, in technical level and quality should conform to the world level and ensure the efficiency of their use in the national economy of the country and their competitive ability on the foreign market.

The following stages of the development and delivery of items to production are envisaged by the state standards of the system:

1. The drafting, coordination, and approval of the technical assignment.

2. The drafting of the technical specifications.

3. The production of prototypes (test batches).

4. The testing and acceptance of prototypes (test batches), the making of decisions on the delivery of the product to production.

5. The preparation of the production of the product.

6. The assimilation of the product in production.

The technical assignment for the development of an item should contain technical requirements, which specify the quality of the product and its operating characteristics, demands on the reliability, economy, technological feasibility, the level of standardization and unification, safety and environmental protection, aesthetic and ergonomic requirements, the conditions of use, and so on. The economic indicators, including the efficiency, the payback period, the limit price, and others, should be included without fail in the technical assignment and the procedure of the checking and testing of the item should be established.

For the purpose of the further simplification of the procedure of delivering items to production by the corresponding changes it was established that it is possible not to draw up technical assignments for items, which are most simple in design, items, which are produced in accordance with existing models or are intended only for export (if the necessary information is present in the contract), as well as for food products.

The prototypes of a product undergo preliminary and acceptance tests.

The preliminary tests, as a rule, are conducted at the producer plant for the checking of the conformity of the specimen to the technical assignment and the requirements of the standards and technical specifications, for the identification of possible defects, as well as imperfections of the technical specifications, and, in the end, for the determination of the possibility of presenting the specimen for acceptance tests.

In case of acceptance tests the evaluation of the technical level of the product is made and the possibility of its delivery to production is determined.

The acceptance tests can be:

—state;

—interdepartmental;

—departmental.

The main organizations for state tests for the types of products attached to them conduct state acceptance tests of the most important types of products for production engineering, cultural, and household purposes. For large-scale, large-tonnage items the tests are conducted at the place of installation, under operating conditions.

The corresponding acceptance (state, interdepartmental, departmental) commissions are established for the supervision of acceptance tests. Representatives of the client, the main organization, the developer, the producer, and organs of state inspection, for consumer goods, moreover, representatives of the Ministry of Trade, and, for items intended for export, representatives of the USSR Ministry of Foreign Trade (or its associations) are included on them.

The check tests of products of series, mass, and custom production can be:

—approval tests;

—periodic tests;

—tests of the trial run and the first industrial batch (qualification tests).

The approval tests are conducted by the technical control service of the producer enterprise with the participation of a representative of the client and organs of state acceptance.

Periodic tests are conducted for the purpose of evaluating the conformity of the product to the requirements of standards and specifications, as well as the stability of the quality and the conformity of the product to the assigned quality category. Such tests are conducted by the producer enterprise, the main organization for state tests, or another specialized organization for product tests. Representatives of the client, state acceptance, and foreign trade organizations are enlisted in the tests.

The tests of the trial run (the first industrial batch) are conducted for determining the readiness of production for the series (mass) output of the product.

Once again it is necessary to note that the USSR State Committee for Standards is performing continuous work on the improvement of the System of the Development and Delivery of Products to Production. Here, on the one hand, the demands on the drawing up of documentation and the improvement of the preparation of production are being increased and the system of state tests is being strengthened and, on the other, the time for getting an agreement is being shortened, the drawing up of technical assignments for the simplest items is being eliminated, and so forth.

The System of Classification and Coding and Unified Systems of Documentation

In the Basic Directions of USSR Economic and Social Development for 1986-1990 and the Period to 2000, which were approved by the 27th CPSU Congress, it is indicated: "To continue the development and to increase the efficiency of the operation of collective-use computer centers, integrated data banks, and information processing and transfer networks."

The accomplishment of this task requires the creation of a common information base, a common language, and common forms of documents. Without this the information compatibility and efficient use of computer hardware on the scale of the country are impossible.

In the Soviet Union for the assurance of the operation and interaction of automated control systems at all levels of management—the statewide, sectorial, and territorial levels and the level of the association and enterprise—the USSR State Committee for Standards, the USSR State Planning Committee, and the USSR Central Statistical Administration jointly with ministries and departments developed and introduced sets of state standards, as well as sectorial and republic documentation in the area of classification and coding (the Unified System of Classification and Coding) and unified systems of documentation (USD's), which include more than 30 unionwide classifiers of technical and economic information (OKTEI's) and 16 systems of unified documentation.

Moreover, the broadening of the cooperation of the CEMA member countries and the intensification of their economic integration required the establishment of a number of classifiers, which are common to all the CEMA member countries, moreover, the General Classifier of Industrial and Agricultural Products of the CEMA Member Countries (OKP SEV), which was approved in 1980 and is used in CEMA organs, international economic organizations, and the countries of the community, is the basic one of them.

The Unified System of the Classification and Coding of Technical and Economic Information

The system of classification and coding consists of a set of classifiers, in which various types of technical and economic information—on the products of industry and agriculture, operations and services, on organs of state

management, on objects of the administrative and territorial division, on sectors of the national economy, on natural and manpower resources, on points of the loading and unloading of products and raw materials on various types of transport (rail, water, motor, air), and others—were gathered together and received codes.

The entire set of prevailing classifiers of technical and economic information are divided into the following categories: unionwide, sectorial, and republic classifiers and classifiers of enterprises.

The unionwide classifiers, which are approved by the USSR State Committee for Standards, are the common language for all levels of management.

The sectorial classifiers are used within the sector for the exchange of information between the automated control systems of the sector and the automated control systems of enterprises of sectorial subordination.

The republic classifiers serve as an intermediary between the automated control systems of the republic, the automated control systems of republic ministries and departments, and the automated control systems of enterprises of republic subordination.

In turn, the classifiers of enterprises find application within the automated control systems of enterprises (associations) and other structural subdivisions of ministries and departments.

The comprehensive development of unionwide classifiers ensured the possibility and the efficiency of their use when solving problems of management, planning, accounting, distribution, financing, pricing, and so forth in industry, agriculture, construction, transportation, personal service, and others.

The Unionwide Classifier of Industrial and Agricultural Products (OKP) is the central part of the system of classifiers. More than 20 million descriptions of products being produced, which are an object of delivery, have been included in it, have been classified, and have been coded.

For the first time on the scale of the entire national economy the products list, which is used in case of planning, accounting, and reporting, in supply and trade, and in case of pricing, is coordinated in the Unionwide Classifier of Industrial and Agricultural Products.

At present the Unionwide Classifier of Industrial and Agricultural Products is being used in all spheres of management of the national economy.

On the basis of the codes of the Unionwide Classifier of Industrial and Agricultural Products the products list is formed when drafting the plans of production and the balance sheets and plans of distribution in the USSR State Planning Committee, the USSR State Committee for Material and Technical Supply, ministries and departments, union republics, associations, and enterprises. The codes of the Unionwide Classifier of Industrial and Agricultural Products are entered in standard (standards and technical specifications) and design documentation (in the specification of drawings), price lists, and reporting and accounting documentation on supply and marketing.

As a whole the Unionwide Classifier of Industrial and Agricultural Products is a summary of the descriptions of industrial and agricultural products and their codes, which are arranged in the order of the classification of products.

The code symbols of a product consist of 10 numeric characters and include a classification part (6 characters) and an identification part (4 characters).

The classification part—the highest classification groupings (VKG-OKP)—reflects the most important technical and economic attributes, which are consequently developed into five levels of classification. All products are broken down by classes (there are 98 of them in the Unionwide Classifier of Industrial and Agricultural Products), subclasses, groups, subgroups, and types. Here the types receive their further development (concretization) in the complete (assortmental) list in case of the addition of the code of the identification part of the full code symbol to the code of the highest classification groupings of the Unionwide Classifier of Industrial and Agricultural Products.

The structure of the identification part depends on the specific product and is realized mainly by the assignment to it of a registration number.

Thus, metal-cutting machine tools, forge and press, casting, wood working, and several other types of production equipment are covered by class 38 of the Unionwide Classifier of Industrial and Agricultural Products. But the characteristic of the type of equipment—metal-cutting machine tools—will have the code 381 (according to the class); the characteristic of the technological purpose—lathes—is 3811 (group); the degree of automation—automatic and semi-automatic machines of the lathe group—is 38111 (subgroup); the design characteristic—automatic lathes—is 381111 (type). Consequently, such a type of equipment is grouped with highest classification grouping 381111 of the Unionwide Classifier of Industrial and Agricultural Products.

Then comes the identification part: the design character—automatic single-spindle lengthwise-turning lathes—is 381111 1; the basic parameter—automatic single-spindle lengthwise-turning lathes with a rod diameter of 4 millimeters—is 381111 11. The next two symbols are the ordinal number of the specific item and the specific model. For example, the full code number of

the model 03 high-precision automatic single-spindle lengthwise-turning lathe with a rod diameter of 4 millimeters will be 381111 1103.

Unified Systems of Documentation

The work on the unification of all types of documentation, which is being carried out both at the intersectorial and sectorial levels and at the level of regions, is of great importance for the improvement of management in all spheres of the national economy.

The use of documents, which are unified in form and content, makes it possible to increase the productivity of management labor, to speed up and to reduce significantly the number of forms of documents, which are being used, and to regulate the flow of their movement, and to eliminate unnecessary, redundant information.

The formalization of information in unified documents makes it possible to use computer hardware extensively and more effectively in the sphere of management.

At present 35 state standards, which encompass 16 systems of documentation, including planning, statistical reporting, primary accounting, financial, and organizational administrative documentation, as well as documentation on material and technical supply, pricing, domestic and foreign trade, inventions, social security, and personal service and in the area of capital construction, are in effect in the country.

For all organs of management, from central to local organs, the system establishes not only uniform rules of the preparation of documents, but also a unified structure of forms (letters, orders, directions, acts, forecasts, instructions, and others). All this to a significant degree decreases the labor expenditures on the preparation of documents. Moreover, the sample blank is the uniform model for the unification of documentation.

At present the sample blank has been approved as a state standard—a unified layout of requisitions and an entire set of demands on the form of organizational documentation have been regulated. The introduction of this standard had the result that the number of forms of previously used documents was reduced from approximately 2,000 to several tens, and especially in the system of documentation on material and technical supply and trade and monetary settlement documentation.

Work is now being performed on the further development and improvement of the unified system of classification and coding and the unified system of documentation.

For the assurance of the unity of classification and coding the State Scientific Research Center of the Management of Unionwide Classifiers (GNITsVOK), to which the coordination, procedural supervision, and automated management of classifiers and unified systems of documentation have been assigned, has been established in the system of the USSR State Committee for Standards.

Summarizing the foregoing, it should be said that the work on the further improvement of intersectorial organizational methods and general technical systems of standards is continuing without interruption, which is an objective consequence of the processes, which are occurring in the national economy, and the transformations, which are due to the restructuring and intensification of the economy.

Thus, in connection with the improvement of the economic mechanism, the introduction of cost accounting, self-support [samookupayemost], and self-financing, and the broadening of the rights of associations and enterprises the objective need for the further regulation of the activity in the area of standardization appeared.

For the purpose of creating the necessary conditions for the acceleration of the development and assimilation in production of new machine building products in January 1986 the USSR Council of Ministers commissioned the USSR State Committee for Standards, ministries, and departments to take the necessary steps on simplifying the procedure of drawing up technical specifications for new equipment.

In particular, the USSR State Committee for Standards was charged to eliminate from state standards the methods provisions, which regulate the procedure of performing work when developing new equipment, having included these provisions, if necessary, in documents of a recommendatory nature.

Based on the fact that in a number of systems of standards there were standard documents, which were of a purely procedural nature and did not find extensive application in industry, while the systems themselves had not undergone further development, the USSR State Committee for Standards eliminated several of them, including the System of the Optimization of the Parameters of Objects of Standardization, strength analyses and tests in machine building, expert methods of the evaluation of quality, the System of the Maintenance and Repair of Equipment, and others—in all 15 sets.

The decision was also made to develop a common standard, which specifies the basic provisions of state product tests, and to include it in the system of the development and delivery of items to production. It was considered advisable to have within the State System of Standardization a standard for the determination of the efficiency of standardization.

The question of the maximum unification of standards for automated systems of designing, the preparation of production, and control (computer-aided design systems, automated systems of scientific research, automated systems of the technological preparation of production, automated control systems) was examined, while keeping in mind in the future the changeover to a common set of standards of automated systems for various purposes. The establishment of this set should in the immediate future ensure the organizational methods unity of the work on the development of automated systems, the achievement of their information, software, and hardware compatibility, and the significant increase of the level of unification and standardization of software and hardware.

The USSR Sate Committee for Standards decided to continue the work on the improvement and streamlining of intersectorial systems of standards, to make systematically an analysis of the collection of prevailing organizational methods and general technical standards and documents for guidance, and on this basis to carry out the further streamlining of the structure and composition of intersectorial sets of standards and to increase the scientific and technical level of the standards, which at present both are included and are not included in these sets. The decision was made to perform this work in such main directions as the standardization of:

—the rules of the organization of the performance of work on standardization;

—the basic rules of the performance of work at all the stages of the life cycle of a product;

—the rules and demands, which ensure information unity;

—the rules and norms of metrological service, which ensure the unity of measurements;

—the general technical rules, norms, and demands, which regulate the general properties of a product.

The scientific methods supervision and coordination of the work on the streamlining, improvement, and development of intersectorial organizational methods and general technical systems (sets) of standards, as applied to products for national economic purposes, have been assigned to the All-Union Scientific Research Institute of Standardization.

Questions for Self-Testing

1. What is the System of the Development and Delivery of Products to Production?

2. What are the goal and the procedure of the conducting of acceptance and check tests of products?

3. What do the Unified System of the Classification and Coding of Technical and Economic Information and the unified system of documentation give the national economy?

4. What steps have been taken for the simplification of the procedure of drawing up technical specifications for new equipment?

Footnote

1. Conclusion. See the beginning: *Standarty i Kachestvo*, No 7, 1987.

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Activity of Standardization Services

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[Article by F.A. Feldman and T.V. Goncharova, the All-Union Scientific Research Institute of Standardization, under the rubric "New Standard Documents": "The Basic Directions of the Activity of Standardization Services in the Country"; first in a projected series of two installments]

[Text] The main and base organizations for standardization are the most important unit in the system of standardization services in the country. Whereas the departments of standardization of ministries and departments perform the role of administrative technical supervisors in the sectors, while the departments of standardization of associations, enterprises, and organizations are the immediate vehicles of the tasks of standardization in case of the designing and production of a product, the main and base organizations are the coordinating, scientific methods, and practical centers for the performance of work on standardization, which ensure technical unity in the sectors of the national economy both in the area of the establishment of general technical and organizational methods norms and regulations and in the area of the normalization of the technical, economic, and qualitative indicators of the product being produced.

The duties of the all-union main and base organizations for standardization are assigned to the main (leading) scientific research institutes, planning and design and technological organizations, and scientific production associations (enterprises). In accordance with the representation of ministries (departments) the USSR State Committee for Standards approves the List of Main and Base Organizations for Standardization.

The new model statutes on the main organization for standardization (GOS) and the base organization for standardization (BOS) establish the basic directions of the activity and the duties and rights of these organizations, on the basis of Decree No 13 of the USSR Council of Ministers of 7 January 1985 "On the Organization of Work on Standardization in the USSR" and the provisions of the new version of standards of the State System of Standardization (GSS-85).

The Model Statute on the Main Organization for Standardization (Working Document 50-1.623—86)

In accordance with the model statute, the main organization for standardization, subject to the specific nature of the sector and the work being performed, drafts a statute for its organizations, which is approved by the management of the ministry (department), to which it is subordinate, or includes the functions, duties, and rights of the main organization for standardization in the prevailing statute on this organization.

If there are several main organizations for standardization in the system of the ministry (department), one of them can be approved as the central main organization (TsGOS), which carries out the coordination of the work of the main organizations for standardization of the ministry (department). The tasks, duties, and rights of the central main organization for standardization are specified by the ministry (department).

The main organization for standardization should perform the work on standardization in conformity with the plan of standardization, which is a component of the thematic plan of the organization. The manager directly, as well as the managers of the corresponding subdivisions (services) bear responsibility for the organization and completion of the work being performed by it.

The activity of the main organization for standardization is carried out in the following basic directions:

—The Organizational Methods Support of the Development of the System of Standard Technical Documentation of the Sector. For the accomplishment of this task the main organization for standardization should:

1. Formulate (participate in the formulation) and introduce new methods and forms of the organization and implementation of work on standardization in the system of the ministry (department) under the conditions of the increase of the independence of associations and enterprises and the establishment of national economic interbranch complexes, interbranch scientific technical complexes, scientific production and production associations, and joint associations and enterprises with socialist and capitalist countries.

2. Participate in the formulation, the scientific methods support, and the coordination of work in the system of the ministry (department) on the development and introduction of organizational methods and general technical sets of standards.

3. Conduct scientific research work on the determination of the scientific and technical level and the prospects of development of the work on standardization and unification in the sector, on the basis of the analysis and generalization of the achievements of science and technology and the characteristics of the product being standardized, which is produced in the USSR and abroad. Provide the base organizations for standardization, as well as the organizations and enterprises, which are the developers of standards, with the appropriate information.

4. Formulate the scientific methods principles of standardization in the sector and organizational methods documents, which establish the peculiarities of the procedure and the methods of the performance and organization of work on standardization in the sector.

5. Coordinate the work of the base organizations for standardization, enterprises, scientific research institutes, and design bureaus on the drawing up of drafts of CEMA standards, state standards, and sectorial standard technical documents and prepare proposals on the drawing up of drafts of standards for related sectors of the national economy; monitor the fulfillment in the sector of the plans of the drafting of these documents, as well as scientific research and experimental work, which is connected with the drafting and introduction of state and sectorial standards.

6. Ensure the increase of the productivity and quality of labor in case of the performance of work on standardization by the use of automation equipment and computer hardware.

—The Organizational Methods Support of the High Scientific and Technical Level of the Standard Technical Documents Being Drafted in the Sector. In this connection the main organization for standardization is obliged:

1. To draw up generalized proposals of the ministry (department) for long-range planning documents and plans of standardization, as well as drafts of plans of sectorial (republic) standardization, to ensure their coordination with other sections of planning documents and plans of the economic and social development of the sector, and to analyze the fulfillment in the system of the ministry (department) of the plans of standardization.

2. To specify jointly with the base organizations for standardization the demands on delivered raw materials, materials, semifinished products, components, and tools, which are used in the sector, and to draw up

generalized proposals for long-range planning documents and plans of state and sectorial standardization of related sectors of industry for the purpose of ensuring comprehensiveness in the performance of the work.

To examine similar proposals of other ministries (departments).

3. To draw up generalized proposals on scientific and technical goal programs on the increase of the quality and reliability of a product in the area of:

—the forecasting of the indicators of the technical level and quality of the most important types of products with allowance made for the requirements of international standards, which ensure their competitive ability;

—the drawing up of standard technical documentation, which establishes the long-range demands on a product.

4. To carry out the organizational methods supervision and to provide procedural assistance in the formulation of standards; to make in accordance with established procedure a scientific and technical evaluation and a legal evaluation of the drafts of standards for the purpose of checking the conformity of the demands, which are cited in them, to the world level, to international standards, and to promising scientific and technical achievements; to carry out the monitoring of the conformity of the demands of the drafts of standards for general industrial products to the needs of the defense of the country.

5. To draft standards and documents for guidance on standardization, including addenda to standards, in conformity with the objects of standardization, which are attached to the main organization for standardization, and to carry out their coordination with interested organizations and representatives of the client.

6. To perform work on the registration of standard technical documents and timely information on approved sectorial standards, specifications, and documents for guidance on standardization of the ministry (department), to prepare for publication and to provide these documents in accordance with established procedure to the enterprises of the sector, and to carry out the subscriber registration of standards and documents for guidance on standardization, which are attached to the main organization for standardization.

7. To carry out the planned checking of standards (the examination of the lists of standards to be checked, which have been compiled by the base organizations for standardization; the inclusion of the assignments on the checking of standards in the corresponding plans of standardization; the examination and approval of the results of the check; the carrying out of the monitoring of the implementation of the results of the check).

—The Carrying Out of the Organizational Methods Supervision of the Work on the Introduction of Standards at Enterprises and Organizations of the Ministry (Department) and the Departmental Monitoring of Their Observance. For the implementation of this direction the main organization for standardization should:

1. Draw up generalized proposals on the introduction of standards for inclusion in the plans of the development of the sector and submit them to the ministry (department) in accordance with established procedure.

2. Draw up (with the enlistment of base organizations) generalized proposals for the plans of state inspection and departmental monitoring of the introduction and observance of standards and specifications.

3. Participate in sample checks of the quality of the output being produced by enterprises, which are made by organs of the USSR State Committee for Standards and the inspectorate for quality of the ministry (department); analyze the state of the introduction and observance of standards in the sector and prepare as needed proposals on the elimination of shortcomings.

4. Draw up (with the enlistment of the base organizations for standardization) lists of items and materials, which are permitted to be used.

—The Scientific and Technical and Organizational Methods Supervision, the Coordination of the Activity, and the Monitoring of the Work, Which Is Performed by Organizations (Enterprises) of the Ministry (Department) Within the Framework of CEMA and Along the Lines of the International Organization for Standardization, the International Electrotechnical Commission, and Other International Organizations for Standardization in Accordance With Bilateral Scientific and Technical Cooperation in the Area of Standardization. Here the main organization for standardization carries out:

1. The generalization of the proposals of the base organizations for standardization for the drafts of plans of state and sectorial standardization in the area of work, which is being performed within CEMA and along the lines of the International Organization for Standardization, the International Electrotechnical Commission, and other international organizations for standardization.

2. The monitoring of the drawing up, coordination, and submitting in accordance with established procedure of drafts of international standards, of which the USSR is the author, as well as the submitting of conclusions on the drafts of international standards, of which other member countries of the International Organization for Standardization and (or) the International Electrotechnical Commission for the technical organs of the International Organization for Standardization and (or) the International Electrotechnical Commission, which are attached to the organization, are the authors.

3. The analysis of the conformity of the indicators, norms, and requirements of domestic standard technical documents to international standards, the preparation of proposals on the use of international standards, and the monitoring of their use in the sector. The assurance of the interconnection of the operations on international and domestic standardization in the sector.

4. The monitoring of the introduction of work on the drawing up (coordination) in the USSR of drafts of CEMA standards, which have been attached to the ministry (department). The performance of work on the assurance of the use of CEMA standards in the national economy and contract law relations.

5. Work on the management of the secretariats of the permanent Soviet sections and the secretariats of the technical organs of the International Organization for Standardization and (or) the International Electrotechnical Commission, which are attached to the main organization for standardization, and the provision of the organizations (enterprises) of the sector with information on the activity of the International Organization for Standardization and (or) the International Electrotechnical Commission on the attached themes.

6. The performance of work in accordance with the plans of bilateral cooperation in the area of standardization.

The management of the ministry (department) in conformity with the model statute can grant the main organization for standardization the right:

—to act as representative on behalf of the ministry (department) and on its instructions in other organizations, as well as at conferences of organs of international organizations (CEMA, the International Organization for Standardization, the International Electrotechnical Commission, and others) for questions of standardization;

—to appeal on questions of standardization to the corresponding subdivisions of the USSR State Committee for Standards and to other ministries (departments);

—to approve technical assignments for the drafting of standards on the instructions of the ministry (department). To adjust (within the limits of the period of the completion of the work) the deadlines of the completion of individual stages of the work, which are established by the technical assignments that are approved by the main organization for standardization;

—to carry out the monitoring of the work of subordinate base organizations for questions of standardization, as well as the monitoring of the introduction and observance of standards and other documents on standardization in organizations and enterprises of the sector;

—to make decisions on the sending for approval of submitted drafts of standards and other standard documents on standardization or on their return for modification;

—to demand from the base organization for standardization and other organizations and enterprises of the ministry (department) materials and information, which are necessary for the fulfillment of the duties of the main organization for standardization;

—to make decisions on controversial questions of the drafting, use, and introduction of standards in the ministry (department);

—to submit to the ministry (department) conclusions on the quality of the work on standardization, which has been performed by organizations and enterprises of the ministry (department), and suggestions on the elimination of identified shortcomings and on the giving of incentives to organizations, enterprises, and individual workers, who ensure the fulfillment of work on standardization at a high scientific and technical level;

—to receive in accordance with established procedure standard technical documents which have been approved by other ministries (departments).

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Intersectorial Standards in Acceleration of S&T Progress

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[Article by Candidate of Technical Sciences Yu.D. Amirov, the All-Union Scientific Research Institute of Normalization of Machine Building, under the rubric "The Theory, Methods, Practice of Standardization. Questions of Theory": "Intersectorial Sets of Standards in the Tasks of Accelerating Scientific and Technical Progress (For Purposes of Discussion)"; first paragraph is STANDARTY I KACHESTVO introduction]

[Text] From the editorial board. The All-Union Scientific Technical Conference "The Shortening of the Time of the Development and Assimilation of New Equipment" will be held in September 1987 in Tula. The article published below is devoted to one of the aspects of the solution of this problem by means of standardization.

The acceleration of scientific and technical progress is a complex problem. Its elaboration presumes the intensive increase of the scientific and technical level of items with

the simultaneous shortening of the time of their development and assimilation. Standardization is one of the effective means of solving the listed problems.

Organizational methods standards play an important role in the selection and extensive dissemination of effective methods of solving the scientific, technical, and organizational problems of the acceleration of scientific and technical progress at the stages of the life cycle of a product.

The Analysis of the State of Standardization in the Area of the Development, Assimilation, and Use of New Equipment

The sets of organizational methods and general technical standards for the system of the development and delivery of a product to production (SRPP), the Unified System of the Technological Preparation of Production (YeSTPP), the unified systems of design and technological documentation (YeSKD, YeSTD), and others have found extensive application in the area of the development and use of new equipment. The experience of the development and use of sets of state standards of the SRPP and the YeSTPP of items of machine building, instrument making, and automation equipment, for example, testifies to the great national economic impact of these systems.

With the development and introduction of the set of standards of the SRPP in the country the prerequisites were created for such an organization of the management of experimental design work and established production, in case of which the effective monitoring of the conformity of the quality of the object of development to the requirements of the technical assignment and the constant maintenance of the product being developed and produced at the required level, and, in necessary instances, the timely halt of the development and output of a product, which does not satisfy the demands of the national economy, the population, and export, can be ensured.

The formation for the first time in engineering practice of a single chain: "the unification and the assurance of the technological feasibility of the designs of items—the development and use of standard and group technological processes—the standardization and unitizing of adjustable means of technological equipment—the mechanization and automation of production and engineering labor" was one of the most important results of the development of the YeSTPP, which is of fundamental importance for the further shortening of the time of the development and assimilation of new equipment. As the experience of many associations and enterprises showed [1], the active and comprehensive introduction of methods of standardization in the practice of the designing of new equipment and technology and the improvement of the forms of the organization of the production of items and means of technological equipment makes it possible to increase labor productivity in basic and ancillary production, to shorten to two-fifths to two-thirds the time of the assimilation of a new product (see the drawing), and to save considerable manpower and material resources and creates the prerequisites for the rapid introduction in production of the latest equipment and technology and the changeover to flexible production systems. The creative cooperation of designers and process engineers in the development and assimilation of new equipment is strengthened significantly.

However, it should be noted that as a whole the development of the collection of organizational methods standards took place extensively, that is, in the direction of the increase of the great number of frequently not interconnected standards and their sets (Table 1). As a result their effectiveness was, as a rule, of a limited nature, which is due to the comparatively narrow area of application and sphere of effect of each of the sets in question.

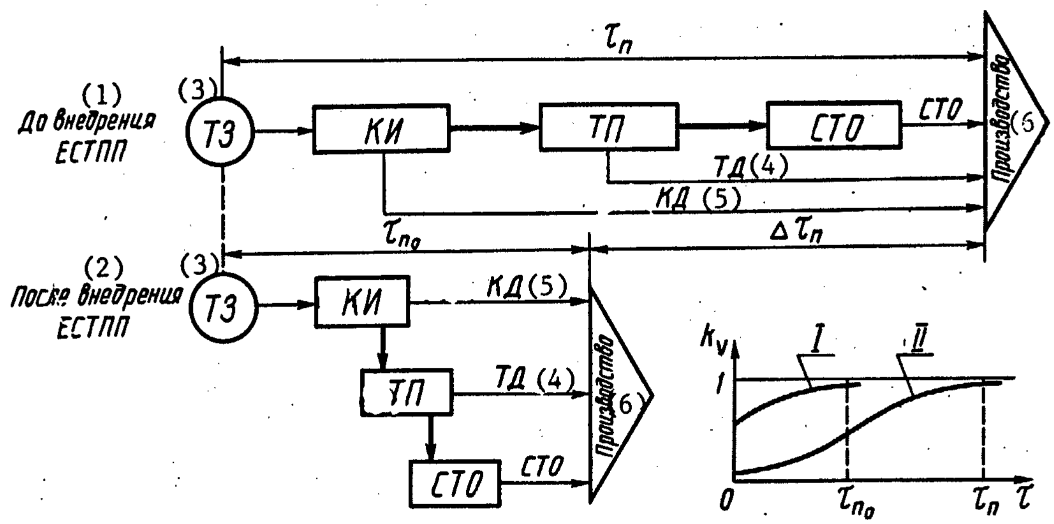
The excessive regulation of the activity of designers and process engineers, which paralyzes their creative initiative, was a substantial shortcoming, which required the elimination of a number of systems of standards and their significant simplification and improvement.

At the same time in the prevailing organizational methods standards the regulation of the demands on the assurance and the evaluation of the technical level and quality of a product is of an unsystematic random nature. Very often the values of the indicators and the specific demands on their assurance are not regulated.

The collection of standards for products and standards for the organization and the methods of performing work on the development and use of a new product until recently developed independently.

The difference of the indicated standards should consist only in the fact that the standards for a product specify by means of specific indicators, norms, and demands the ultimate goal and constraints of the development and use of the product, while the standards for the processes of its development, assimilation, and use specify the procedure and the rules of the implementation of the demands on these indicators and norms at different stages and phases of the life cycle of the product. Not by chance is the development of individual types of standards for a product already today being linked to a greater and greater extent with the stages of its life cycle. Standards with long-range demands can serve as examples.

Unfortunately, this applies to a lesser degree to other types of standards for a product, as well as to the formulation and implementation of programs of comprehensive standardization.



The influence of the YeSTPP on the shortening of the duration of the processes of the development and assimilation of new equipment (КИ is the designing of an item; ТП is the planning of technological processes; СТО is the development of means of technological equipment; τ_n, τ_{no} are the duration of the preparation of production before and after the introduction of the YeSTPP; κ_v is the coefficient of the completeness of technical solutions)

Key:
1. Before introduction of the YeSTPP
2. After introduction of the YeSTPP
3. Technical assignment
4. Technical documentation
5. Design documentation
6. Production

The elimination of the noted shortcoming would signify the achievement of the changeover to a unified procedure of the formation and use of the set of standard technical documents for a product and for the processes of its development, assimilation, and use in the national economy.

Taking into account the special-purpose unity of the collection of standards for a product and the processes of its development and use, it is possible to accomplish the maximum simplification of the entire collection of standards and to increase its effectiveness substantially from the standpoint of the improvement of product quality in conformity with the present requirements.

In this case such negative phenomena as the incomplete coverage of a product by standards or the duplication of requirements in standards of different types and categories, the lack or inefficiency of the regulation of the areas of their dissemination, the lack of interconnections and continuity between the types and categories of standards, and the existence of redundant information in standards and redundant types and categories of standards in general will be eliminated from standardization.

The Urgent Tasks and Prospects of the Development of Sets of Organizational Methods Standards in the Area of the Development, Assimilation, and Use of New Equipment

The requirements of the acceleration of scientific and technical progress and the achievement of the highest ultimate impact as a result of the development and use of new equipment in the national economy dictate the need for the qualitative updating of the prevailing collection of organizational methods and general technical standards, and first of all the assurance of the consistency and compatibility of standard technical documentation over the entire life cycle of a product.

It is possible to name the following as the basic, urgent tasks of the systems regulation of the collection of organizational methods and general technical standards in the area of the development, assimilation, and use of new equipment:

—the formation of a unified, most simple and structurally flexible set, which is modern in content, of standards that establish a unified system of the development, assimilation, and use of new equipment;

(1) Аспекты стандартизации	(2) Стадии жизненного цикла продукции										
	(3) Исследование	(4) Проектирование изделий	(5) Проектирование технологических процессов	(6) Проектирование, изготовление и применение средств ТО	(7) Проектирование и применение САПР	(8) Проектирование и применение ГПС (в т. ч. АСТПП)	(9) Изготовление продукции (в т. ч. госиспытания)	(10) Транспортирование	(11) Хранение	(12) Техническое обслуживание и ремонт	(13) Утилизация
Основные понятия (14)	(21) Надежность (22) Унификация	(28) ЕССП (25) СТОИРТ (24) ЕСТПП (21) Надежность (22) Унификация	(31) ЕСТД (24) ЕСТПП (21) Надежность	(32) ССТО	(26) САПР	ЕСТПП (24)	Надежность (21)	(25) СТОИРТ Надежность (22)	Надежность (21)	СТОИРТ (25)	
Состав работ (15)	(23) СРПП (24) ЕСТПП Унификация (22)	(23) СРПП (29) ЕСКД (22) Унификация	(24) ЕСТПП	(32) ССТО (29) ЕСКД (24) ЕСТПП Унификация (22)	(26) САПР	ЕСТПП (24)	(23) СРПП Унификация (22)			СТОИРТ (25)	
Основные требования к содержанию работ (16)	(23) СРПП СТОИРТ (25)	(23) СРПП (29) ЕСКД (25) СТОИРТ (22) Унификация (28) ЕССП	(24) ЕСТПП (25) СТОИРТ	(32) ССТО (29) ЕСКД Унификация (22)	(26) САПР	ЕСТПП (24)	(23) СРПП (25) СТОИРТ Унификация (22)			ЕСКД (29)	
Общетехнические нормы и требования (17)	(21) Надежность (22) Унификация	(21) Надежность (22) Унификация (25) СТОИРТ	(31) ЕСТД	(32) ССТО	(26) САПР	ЕСТПП (24)	(21) Надежность (22) Унификация (25) СТОИРТ (28) ЕССП	(21) Надежность (31) ЕСТД Унификация (22)	Надежность (21)	СТОИРТ (25)	
Порядок и методы выполнения работ (18)	(21) Надежность (22) Унификация (23) СРПП (24) ЕСТПП (25) СТОИРТ	(23) СРПП (21) Надежность (22) Унификация (29) ЕСКД (24) ЕСТПП (25) СТОИРТ (28) ЕССП	(24) ЕСТПП (31) ЕСТД (25) СТОИРТ	(24) ЕСТПП (32) ССТО Унификация (22)	(26) САПР	ЕСТПП (24)	(23) СРПП	Надежность (21)	Надежность (21)	СТОИРТ (25)	
Порядок и методы контроля результатов работ (19)	(23) СРПП (22) Унификация (21) Надежность (26) САПР	(23) СРПП (29) ЕСКД (21) Надежность (22) Унификация (25) СТОИРТ (30) ГСИ	(30) СИ (21) Надежность	(30) ГСИ (24) ЕСТПП	(26) САПР	ЕСТПП (24)	(23) СРПП Надежность (21)			СТОИРТ (25)	
Оформление результатов работ (20)	(23) СРПП (21) Надежность (22) Унификация (25) СТОИРТ (26) СИБИД	(21) Надежность (22) Унификация (29) ЕСКД (25) СТОИРТ	(21) Надежность (31) ЕСТД	(29) ЕСКД (31) ЕСТД	(26) САПР ЕСКД (29)	(24) ЕСТПП ЕСТД (31)			Надежность (21)	СТОИРТ (25)	

Table 1. Sets of Standards, Which Determine the Aspects of Standardization by States and Phases

Key:

1. Aspects of standardization
2. Stages of life cycle of product
3. Research
4.Designing of item
5. Designing of technological processes
6. Designing, production, and use of means of technological equipment
7. Designing and use of computer-aided design systems
8. Designing and use of flexible production systems (including automated systems of the technological preparation of production
9. Production of product (including state tests)
10. Transportation
11. Storage
12. Maintenance and repair
13. Salvaging
14. Basic concepts
15. Composition of work
16. Basic demands on content of work
17. General technical norms and requirements
18. Procedure and methods of performing work
19. Procedure and methods of monitoring results of work
20. Registration of results of work
21. Reliability
22. Unification
23. System of development and delivery of a product to production
24. YeSTPP
25. System of the maintenance and repair of equipment
26. Computer-aided design systems
27. SIBID
28. Unified system of standards of instrument making
29. Unified System of Design Documentation
30. State system of tests
31. Unified System of Technological Documentation
32. System of standards of machine tool attachments

—the substantial updating of the objects and aspects of organizational methods and general technical standardization for the purpose of the elimination of the strict regulation of creative processes and at the same time the formation of a file of standard data, which will facilitate the labor of creative workers and will speed up the processing, retrieval, and use of these data in the processes of the development, assimilation, and use of new equipment;

—the assurance of the comprehensive development of the standardization of the demands on a product, on the choice and use of the indicators of product quality, and on the procedure of the settlement of organizational methods and general technical questions at the stages of its life cycle.

The formation of a common set of standard technical documents for all sectors of the national economy, which regulate all the basic organizational methods questions of the performance of work at all the stages of the life cycle of a product, is today the universally recognized goal of the improvement of the existing sets of standards.

When forming such a set it seems advisable to use the interdependent methods principles, which were previously used when developing the YeSTPP and were checked comprehensively under industrial conditions [2, 3]:

—the systems nature of the processes of the development, assimilation, and use of new equipment, which are being regulated, and their reflections in standards of different categories;

—the continuity of the objects, methods, and means of the development, production, and use of new equipment;

—the compatibility of the organizational forms, information aids, software, and hardware, which are used in the processes of the development, assimilation, and use of new equipment.

The fundamental approach to the formation of unified standard technical and methods support in the area of the development, assimilation, and use of new equipment is depicted in the diagram.

The unified standard technical and methods support should be aimed at the accomplishment of the specific tasks of the development of equipment, which were posed by the 27th CPSU Congress.

In this case there should be regarded as the objects of standardization the interconnected processes (block functions), including:

—the processes of the development of the design of an item (block 1), its production (block 3) and use (block 5);

—the processes of the assimilation of items in the spheres of production (block 2) and use (block 4);

—the processes of the study of the dynamics of the needs for new equipment and the formation and consideration of these needs in case of its development with the use of modern scientific and technical achievements;

—the processes of the assurance of the technological feasibility of the designs of items and the precision and stability of technological processes.

In this case it is advisable to take as the basic content of these standards the demands on:

—the formation and monitoring of the parameters on entering and leaving blocks 1-5 of the system;

—the structure, composition, and compatibility of aids by types of support (information support, programs, hardware, and others);

—the standardization of the product at the stages of the life cycle, including the formulation of programs of comprehensive standardization and unification, the choice and use of specific types and categories of scientific and technical documentation for the product, the indicators of its quality, and so forth.

Taking into account the diversity of the real processes of the development, assimilation, and use of a product and the difference of the conditions, which determine the elements of these processes, it is necessary:

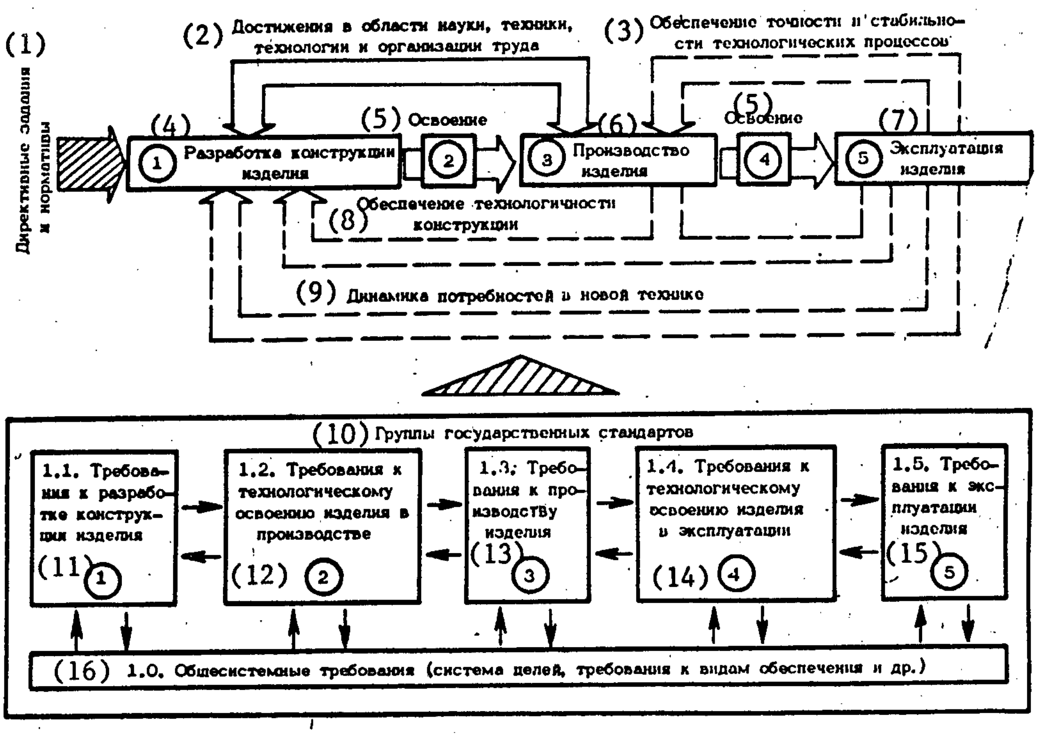
—to establish the advisable levels and aspects of the standardization of organizational methods regulations;

—to specify the standard set of elements of the life cycle of a product (organizational modules) and their standard compositions;

—to specify the rules of the synthesis of organizational modules into systems of the development, assimilation, and use of new equipment with allowance made for the specific needs of social production and the possibilities of the use of computer hardware.

The objects of standardization at the elementary level in organizational methods standards should be represented as mini-algorithms of activity, which have the prospect of repeated use in different spheres of the national economy. In general technical standards only the indicators, norms, and requirements, which characterize the qualitative attributes of the product and apply, as a rule, to all types of products, should be the objects of standardization.

There should be taken as the aspects of standardization in the area of the development, assimilation, and use of new equipment:



The Formation of the Standard Technical Support of the Unified System of the Development, Assimilation, and Use of a New Product

Key:

1. Directive assignments and norms
2. Achievements in the area of science, engineering, technology, and the organization of labor
3. The assurance of the precision and stability of technological processes
4. The development of the design of an item
5. Assimilation
6. Production of the item
7. Use of the item
8. The assurance of the technological feasibility of the design
9. The dynamics of the needs for new equipment
10. Groups of state standards
11. Demands on the development of the design of an item
12. Demands on the technological assimilation of an item in production
13. Demands on the production of an item
14. Demands on the technological assimilation of an item in use
15. Demands on the use of an item
16. Systemwide demands (the set of goals, the demands on types of support, and others)

in organizational methods standards:

—the composition of the work;

—the basic technical demands on the content of the work;

—the procedure of the performance of the work;

—the monitoring and the evaluation of the results of the work;

in general technical standards:

—the basic concepts;

—the general technical norms and requirements;

—the methods of performing the work;

—the registration of the results of the work;

—the methods of monitoring the results of the work.

The breakdown of the work into organizational modules with specific sets of source and resultant data, which are compatible over the entire life cycle of the product, is an urgent task [4]. These modules should be suitable for their automated retrieval and calling, as well as for the synthesis of systems from standard organizational modules. The formation of the base of such organizational modules will make it possible to eliminate the excessive regulation of development, variant reading, and mutually exclusive requirements. Here in state standards it is sufficient to regulate only the key questions of the formation and compatibility of the block functions and the monitoring and transfer of the results from stage to stage, on the basis of the general goal of the system of the development, assimilation, and use of new equipment.

Given the observance of the listed requirements and the formation of the necessary special-purpose and functional subsystems (Table 2) favorable prerequisites can be created for the merging of the processes of the performance of different types of work—from scientific research to the updating of a product during its production and use—by all organizations and enterprises at all levels of management into a continuous process, which is carried out in accordance with uniform requirements and ensures the necessary pace of the acceleration of the socioeconomic development of the country.

The proposed regulation of the objects of standardization and the content of standards will make it possible to simplify as much as possible the composition and structure of the set of standards in the area of the development, assimilation, and use of new equipment, to reduce them to a form that is most convenient for practical use, and to optimize the composition of the requirements and standard decisions as applied to the conditions of the development of real systems by types of equipment, having regulated in so doing the fulfillment at all stages of the life cycle exclusively of the work, which guarantees the rapid development and prompt assimilation of new items, which conform to the highest scientific and technical achievements.

In the process of changing over to a unified set of standard technical and methods documents the positive experience of developing and applying in industry many sets of organizational methods and general technical standards should be used. Thus, when formulating state standards for groups 1.0-1.5 (see the diagram) it is recommended to use the provisions, which satisfy present requirements, of the sets of standards, which have been in effect until recently, in conformity with the data of Table 3. Here greater demands should be made upon the sets of standards, which establish at present the general principles of the formation and the procedure of the choice and use of individual types of support (methods support, information support, programs, hardware). They should be connected with the implementation of the principle of the compatibility of all the processes of the development, assimilation, and use of new equipment in accordance with the corresponding types of support.

For the successful elaboration of the indicated problem and the increase of the scientific and technical level of organizational methods standards it is also necessary:

—to ensure by means of standardization the merging of inventing and standardization tasks when developing new equipment and technology into a unified type of scientific and technical activity [3];

—to establish a unified procedure of the direct assimilation of the achievements of science in case of the performance of experimental design and experimental technological work and the prompt changeover to new, advanced technology (first of all "unmanned" technology, waste-free technology, and technology with few operations);

—to achieve the further development of the scientific and organizational bases of the assurance of the technological feasibility of the designs of items, the increase of the level of their design and technological efficiency and continuity with allowance made for the needs of the spheres of production, use, and repair for the systematic, regular decrease of the expenditures of labor, materials, and power at all stages of the life cycle of items, and the achievement of a high end national economic impact;

—to ensure by means of standardization the type design and the information, program, and hardware compatibility of automated systems of research, designing, the preparation of production, and control, as well as the possibility of the changeover to the integrated automation of scientific and engineering labor in the system of the preparation of production on a common information basis from research and designing organizations to NC equipment;

—to accomplish the further development of the theoretical scientific bases of the standardization and parametric optimization of systems of machines, instruments, and equipment, the introduction of standard methods of analyses and tests, and the use of the goal program method of the planning of work in case of the development, assimilation, and use of new equipment with allowance made for the interconnection of the programs of the complete standardization of products, raw materials, materials, and components with the stages of the life cycle of the product.

The solution of the above-examined urgent problems of the improvement of intersectorial sets of standards will make it possible to increase substantially the role and effectiveness of organizational methods standards in the acceleration of scientific and technical progress in the national economy.

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Целевая установка (1)	(2) Функция создания и применения продукции (Ф)				
	(3) исследование (Ф1)	(4) проектирование (Ф2)	(5) изготовление (Ф3)	обращение (Ф4) (6)	(7) реализация (Ф5)
Формирование, обеспечение и поддержание высокого технического уровня продукции (Ц1) (8)	(11) Исследование потребностей в свойствах продукции и технических возможностей их обеспечения. Формирование стратегии научно-технического развития продукции, методов и средств ее изготовления, обращения и эксплуатации	(14) Разработка новых конструкторских и технологических решений, соответствующих перспективным потребностям народного хозяйства, населения, обороны страны и экспорта	(17) Освоение прогрессивной технологии и средств производства. Разработка предложений по совершенствованию технологических процессов и средств производства	(20) Освоение прогрессивных методов и средств обращения. Разработка предложений по совершенствованию методов и средств обращения	(23) Освоение прогрессивных методов и средств эксплуатации и ремонта. Разработка предложений по повышению технического уровня продукции
(9) Рациональное использование ресурсов (Ц2)	(12) Прогноз расходования и восполнения ресурсов. Исследование возможностей замены ресурсов. Формирование стратегии ресурсосбережения при создании и применении продукции	(15) Эффективное использование имеющегося научно-технического потенциала в новых разработках. Совершенствование форм организации инженерно-технических работ	(18) Эффективное использование имеющегося производственного потенциала. Совершенствование форм организации производственных процессов	(21) Эффективное использование применяемых методов и средств обращения. Совершенствование форм организации процессов обращения	(24) Эффективное использование применяемых методов и средств эксплуатации и ремонта. Совершенствование форм организации процессов эксплуатации и ремонта
(10) Улучшение условий труда человека и охрана окружающей среды (Ц3)	(13) Исследование влияния продукции и перспективных процессов ее производства и потребления на человека и окружающую среду	(16) Разработка специальных методов и средств защиты человека и окружающей среды	(19) Изготовление и освоение новых методов и средств защиты человека и окружающей среды	(22) Освоение новых методов и средств защиты человека и окружающей среды при обращении продукции	(25) Освоение новых методов и средств защиты человека и окружающей среды при эксплуатации и ремонте продукции

Table 2. The Breakdown of Tasks by Groups (Goal-Function) at the Level of the Enterprise

Key:
1. Goal
2. Function of development and use of a product (F)
3. Research (F1)
4. Designing (F2)
5. Production (F3)
6. Circulation (F4)
7. Sale (F5)
8. Formation, support, and maintenance of a high technical level of a production (G1)
9. Efficient use of resources (G2)
10. Improvement of working conditions of man and environmental protection (G3)
11. Study of the needs for the properties of a product and the technical possibilities of their meeting. Formulation of a strategy of the scientific and technical development of a product, methods and means of its production, circulation, and sale
12. Forecast of the consumption of supply of resources. Study of the possibilities of the replacement of resources. Formulation of a strategy of resource conservation when developing and using a product
13. Study of the influence of a production and promising processes of its production and consumption on man and the environment
14. Development of new design and technological solutions, which correspond to the long-range needs of the national economy, the population, the defense of the country, and export
15. Efficient use of the available scientific and technical potential in new developments. Improvement of the forms of the organization of engineering and technical work
16. Development and special methods and means of the protection of man and the environment
17. Assimilation of advanced technology and means of production. Formulation of proposals on the improvement of technological processes and means of production
18. Efficient use of the available production potential. Improvement of the forms of the organization of production processes
19. Production and assimilation of new methods and means of the protection of man and the environment
20. Assimilation of advanced methods and means of circulation. Formulation of proposals on the improvement of methods and means of circulation
21. Efficient use of applied methods and means of circulation. Improvement of the forms of organization of the processes of circulation
22. Assimilation of new methods and means of the protection of man and the environment in case of the circulation of a product
23. Assimilation of advanced methods and means of use and repair. Formulation of proposed on the increase of the technical level of a product
24. Efficient use of applied methods and means of use and repair. Improvement of the forms of organization of the processes of use and repair
25. Assimilation of new methods and means of the protection of man and the environment in case of the use and repair of a product

(1) Комплекс государственных стандартов	(2) Группа стандартов (см. схему)					
	1.0	1.1	1.2	1.3	1.4	1.5
Единая система конструкторской документации (класс 2) (3)	+	+			+	+
Единая система технологической документации (класс 3) (4)	+		+		+	
Единая система технологической подготовки производства (класс 14) (5)	+	+	+	+	+	+
Система разработки и постановки продукции на производства (класс 15) (6)	+	+				
Управление технологическими процессами (класс 16) (7)				+		+
Единая система стандартов приборостроения (класс 26) (8)	+					
Надежность в технике (класс 27) (9)		+		+	+	+
Система технического обслуживания и ремонта техники (класс 28) (10)	+	+			+	+
Система стандартов технологической оснастки (класс 31) (11)	+		+	+	+	+
Унификация в машиностроении (12)	+	+	+		+	
Системы автоматизированного проектирования (САПР) (13)	+	+	+			
Гибкие производственные системы (ГПС) (14)	+		+	+		

Table 3. The Applicability of Sets of Standards in Case of the Formation of the Standard Technical Support of the System of the Development, Assimilation, and Use of New Equipment

Key:
1. Set of state standards
2. Group of standards (see the diagram)
3. Unified System of Design Documentation (class 2)
4. Unified Dystem of Technological Documentation (class 3)
5. Unified System of the Technological Preparation of Production (class 14)
6. System of the development and delivery of a product to production (class 15)
7. Control of technological processes (class 16)
8. Unified System of Standards of Instrument Making (class 26)
9. Reliability in equipment (class 27)
10. System of the maintenance and repair of equipment (class 28)
11. System of standards of machine tool attachments (class 31)
12. Unification in machine building
13. Computer-aided design systems (SAPR's)
14. Flexible production systems (GPS's)

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Streamlining of Systems of Standards

18140022b Moscow STANDARTY I KACHESTVO in Russian No 8, 1987 pp 70-73

[Article by Candidate of Technical Sciences V.M. Postyka under the rubric "The Theory, Methods, Practice of Standardization. Questions of Theory": "On the Question of the Streamlining of Systems of Standards (For Purposes of Discussion)"]

[Text] The increase of the scale of work on standardization and the necessity and at the same time the difficulty of ensuring a systems nature in this work are responsible

for the urgent need for qualitative changes in the methods and organization of work on standardization. These changes should be aimed first of all at the improvement of the general scientific methods bases of standardization and the structure of the state system and sectorial systems of requirements (systems of standard technical documents) with respect to standardization.

The decision of the USSR State Committee for Standards on the elimination of a number of intersectorial systems of general technical and organizational methods standards was announced in the report "On the Streamlining and Optimization of Systems of Standards" [1]. It would be possible, apparently, to continue this list. However, so that the validity of such suggestions would be visible, it is necessary to elaborate and adopt a clear concept of the structure of the Unified State System of Standard Technical Documentation on Standardization and of the structures of sectorial systems of standard technical documents, which correspond to it. Without the solution of this problem any arguments about the necessity of establishing one or another intersectorial or sectorial system of standards and about its composition and limitations will be pointless and unpromising. In this case it is a question of the solution of the problem of ensuring a systems nature in the work on standardization, that is, the mutual compatibility, consistency, unification, and elimination of the duplication of the requirements of various standard technical documents.

In studying the problem of a systems nature as applied to the activity on standardization, it is advisable to examine first of all not the system of standards or standard technical documents on standardization, but the system of demands with respect to standardization on the product (objects) and processes of production on the state, sectorial, or some other scale. This circumstance is due to the fact that when it is a question of a system, a set of some interconnected elements is meant. In this case not documents, but the demands, which are contained in them, actually act as the elements, and the question of an interconnection concerns the demands as such, and not the documents.

The conducted research showed that it is necessary to divide the problem of ensuring a systems nature in standardization into two subproblems:

—the improvement of the general scientific methods bases of standardization and their systematization;

—the improvement of the structure of the system of demands (the system of standard technical documents) with respect to standardization at the state, sectorial, and other levels.

The means and methods of solving the first subproblem are examined in [2, 3], while the obtained results are the methods basis for the solution of the second subproblem. When solving the problem of a systems nature in standardization it is necessary to answer the question: Is it possible to regard the entire set of demands with respect to standardization on the product of the national economy and on the processes of production and management, which are liable to standardization, as a system of demands? It seems to us that the answer to this question should be affirmative. At present a set of elements with connections between them is understood as a system [4].

When settling the question of the structure of the system of demands with respect to standardization, first of all, the goals and principles of standardization should be taken into account, while scientifically sound classifications of the objects of standardization and the types of demands with respect to standardization (the aspects of standardization) and standard technical documentation should also be used. The existence of the mentioned classifications makes it possible to take into account the natural logical connections between its basic elements.

The principles of a systems nature, comprehensiveness, and unification have a most direct bearing on the question of the structure of the systems of demands (the systems of standard technical documents) with respect to standardization. The assurance of the necessary conditions for the effective implementation of the indicated principles also predetermines the basic demands on the structure of the system of demands with respect to standardization.

It seems obvious that the system of demands with respect to standardization on the state or sectorial scale should be a multilevel hierarchical one, which includes a large number of subsystems. What basic subsystems should be singled out within the Unified State System of Demands (System of Standard Technical Documents) With Respect to Standardization (YeSTS) on objects (products) and the processes of their development, production, and use?

Taking into account the different nature of objects (products) and processes as the objects of standardization, as well as the existence of two already formed quite independent state systems of demands on documentation and on measurements, it is advisable to include in the YeSTS the following subsystems:

—the systems of demands on the product;

—the system of demands on the processes of the development, production, and use of the product;

—the system of demands on measurements (the state system of the assurance of the unity of measurements);

—the system of demands on documentation.

It is necessary to note that the last two subsystems, in contrast to the other two, are singled out not with respect to the type of object of standardization, but with respect to the area of activity, since they pertain both to objects (products, documentation) and to different types of processes.

The systematized composition of the basic types of requirements with respect to standardization for a product and processes [2] suggests the very fruitful idea of the possible division of the above-named subsystems at the next level of the YeSTS into subsystems, which are similar with respect to the types of demands. Thus, as applied to a product it is advisable to single out the following four similar or specialized subsystems of demands:

—the system of demands with respect to the classification and coding of the product;

—the system of demands with respect to the terminology for the product;

—the system of demands with respect to the types, the basic parameters and (or) dimensions, and unified items (groups of items);

—the system of general technical demands and technical demands.

At specific levels combined groups of demands like general specifications and specifications for their most part will also be included in the last subsystem.

For the same reasons as for the product it is also proposed to divide the subsystem of demands on processes into parts.

In addition to the subsystems of demands with respect to classification and terminology as applied to processes at the third level of the YeSTS it is proposed to single out another four subsystems that are specialized by types of demands:

—the system of demands with respect to the organization and sequence;

—the system of demands with respect to the rules of the implementation of local processes;

—the system of demands with respect to methods;

—the system of demands with respect to standard technological processes.

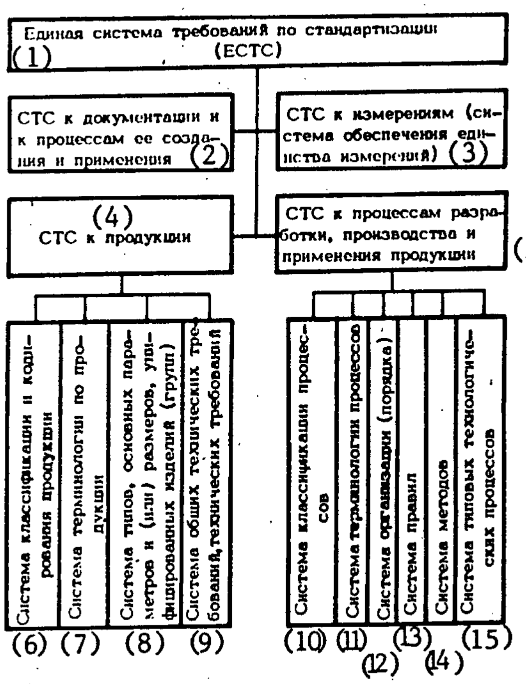
Thus, it is advisable to concentrate all the demands with respect to standardization on the product and processes (the standard technical documents on standardization) in 10 state and accordingly sectorial subsystems, which are specialized by types of objects of standardization and by types of demands. The structure of the three upper levels of the YeSTS is shown in the diagram.

Here it is necessary to stress that when implementing the proposed structure of the YeSTS there should not be one standard technical document on standardization, which is not included in one or another subsystem of it.

In case of the successive division of the distinguished similar subsystems of demands with allowance made for the basic attributes of the division of the objects of standardization and the corresponding types of demands at specific levels of the division all the existing classification groups of a product, the groups of processes of their development, production, and use, and the demands on them with respect to the standardization of all the types, which are presently being distinguished, will appear and will take their place. The principle of comprehensiveness in the work on standardization will thereby be realized.

The advantage of the proposed structure of the state system and sectorial systems of demands (systems of standard technical documents) with respect to standardization consists first of all in the fact that their division into subsystems, which are similar with respect to types of demands, substantially simplifies the distinguished subsystems and systems of demands as a whole and accordingly simplifies the solution of the problem of the devising, effective use, and subsequent development of these systems. The point is that precisely as applied to similar groups of demands with respect to standardization the assurance of their mutual coordination and unification and the elimination of duplication in different standard technical documents is first of all urgent, important, and at the same time most difficult, since they apply to many interconnected objects of standardization.

The corresponding improvement of the organization and the increase of the scientific methods level of the performance of work on standardization are necessary for the implementation of the proposed structure of the YeSTS. In particular, it is necessary to single out scientific research institutes and design bureaus, which are specialized with respect to the named subsystems, for the development of the methodology of the construction and the subsequent management of the corresponding subsystems of demands with the necessary cooperation and coordination of their work. It should be noted that the introduction in practice of the proposed structure of the YeSTS (or any other structure) is possible only on the state scale; its implementation in individual sectors of industry is impossible, since the sectorial systems of standardization and systems of demands on a product and on processes are strictly dependent on more general provisions (demands), which are established simultaneously for all sectors.



Key:
1. Unified System of Demands With Respect to Standardization (YeSTS)
2. System of demands with respect to standardization on documentation and on the processes of its development and use
3. System of demands with respect to standardization on measures (the system of the assurance of the unity of measurements)
4. System of demands with respect to standardization on a product
5. System of demands with respect to standardization on the processes of the development, production, and use of a product
6. System of classification and coding of a product
7. System of terminology with respect to a product
8. System of types, basic parameters and (or) dimensions, unified items (groups)
9. System of general technical demands and technical demands
10. System of classification of processes
11. System of terminology of processes
12. System of organization (sequence)
13. System of regulations
14. System of methods
15. System of standard technological processes

The proposed approach to the construction of systems of demands affords an effective means of accomplishing such an important task as the making of an analysis and evaluation of the state of the distinguished similar subsystems of demands of a different scale (state, sectorial, and others). The forms of the matrices of the analysis of similar subsystems of demands, which make it possible to depict clearly the entire set of elementary groups of demands,[1] which belong to one subsystem or another, were developed for this. These matrices make it possible to evaluate precisely and clearly, including quantitatively, the thoroughness of the implementation of the urgent demands of the subsystem in question, the level of their unification, and the existence of the duplication of the same demands in different documents, as well as to provide sound recommendations on efficient structures of the distinguished similar subsystems.

It is also necessary to stress the following important detail. The implementation of the proposed approach, in addition to ensuring the more precise regulation of the demands with respect to standardization, will decrease significantly the required number of standard technical documents on standardization and accordingly will decrease the expenditures on their drafting, revision, and so on. Thus, the analysis of several similar subsystems on the basis of the proposed approach showed that the required number of standard technical documents, which are included in them, can be reduced by 25 percent and more by the elimination of the duplication of demands in various standard technical documents and the elimination of standard technical documents, which do not contain specific demands.

As was noted in [2, 3], the concepts of the "general technical" and "organizational methods" standard has nothing to do with the question of the content of standards and that the standards of any type, which with respect to the area of dissemination are actually general technical ones, should be called general technical standards, while the standards, in which questions of the organization and methods of the implementation of some processes or others as objects of standardization are regulated, should be called organizational methods standards. In connection with what has been noted, systems of general technical and organizational methods standards are not singled out in the proposed structure of the state and sectorial systems of demands (systems of standard technical documents) with respect to standardization. The concept "general technical standards" concerns all the subsystems of the YeSTS of the third level, since the elements of the upper levels of these systems will contain demands with a general technical area of their dissemination. But here in each subsystem these standards will include demands of a quite specific type (content), which corresponds to each specific subsystem.

Returning to the questions raised in [1] and taking into account what has been stated in this article, it is possible to draw the following conclusions:

1. It is advisable to unite all the intersectorial systems, which pertain to different types of documentation (their conditional numbers are 2, 3, 6, 7, 13, 19, and 21), into the general "System of Demands With Respect to Standardization on Documentation and on the Processes of Its Development and Use" (see the diagram) with the singling out in it of the necessary subsystems.

2. One should single out as an independent subsystem, as is also happening at present, system 8 (the state system of the assurance of the unity of measurements).

3. It is advisable to use the system of the development and delivery of a product to production [15] as the basis for the development of a statewide system of demands with respect to questions of the organization (sequence) of the implementation of the processes of the development, production, and use (operation) of a product.

4. It is necessary to eliminate all other presently existing intersectorial systems of standards, having included the urgent demands with respect to standardization, which are contained in them, in the corresponding similar subsystems of demands of the YeSTS. Here it should be noted that the majority of existing intersectorial systems of standards are sets of elements, which are dissimilar, vague with respect to composition and content, and poorly interconnected.

5. The state system of standardization holds a special position, which is different from all the subsystems of the YeSTS. In addition the structure of the YeSTS is also specified (should be specified) precisely in it.

Footnote

1. By an elementary group of demands with respect to standardization there is understood the smallest possible group, which can be the subject of independent regulation in standard technical documents on standardization.

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7807 Moscow KHOZYAYSTVO I PRAVO in Russian No 4, Apr 87 pp 10-13

Factors Relating to Introduction of New Technologies Discussed

Moscow KHOZYASTVO I PRAVO in Russian No 4, Apr 87 pp 10-13

[Article by V. Pokrovskiy, doctor of economic sciences: "For theIntroduction of New Technologies"]

[Text] In the field of scientific and technical progress, technology is becoming the basis for development of new types of machines and equipment. Practice shows that new technologies contribute significant economic results.

The decisions of the 27th CPSU Congress and Plenums of the party's Central Committee point not to simple improvement of existing technologies and partial modernization of machines and equipment but to cardinal renewal of fixed capital, retooling of all sectors of the national economy and a transition to basically new production systems and equipment of the latest generations.

At the same time, many of these important questions either remain outside the limits of legal regulation or their regulation is of a general character and does not meet the vital need of accelerated growth of public-production efficiency on a new technological basis. Clear and effective legal regulations for the introduction of the results of completed research and development are lacking.

In order for the organizational legal mechanism to provide for the unification of a single state scientific and technical policy, it in particular should include without fail both measures serving as an incentive for desired behavior and also measures of accountability for violation of established rules. The absence of effective forms of responsibility in the sphere of introduction results in the fact that even concrete norms of an imperative character are not always adhered to, but this does not entail any consequences for enterprises or institutions.

In Basic Directions of USSR Economic and Social Development for 1986-1990 and for the Period to the Year 2000, introduction is specified on a mass order of progressive basic technologies determining the technico-economic level of basic production processes in sectors and individual production operations. Five-year plans contain not only targets for expanding the scale of use of such technologies but also basic programs for the solution of intersectoral scientific and technical problems and the creation of fundamentally new technologies. Specifically, there will be introduced more than 35 new production processes based on self-dissemination of high-temperature synthesis. This technology, created by Soviet scientists, ensures lowering material and capital outlays by a factor of 3-5. In the course of the 5-year plan, it is planned to make more than 7,000 rotor and rotor-conveyor lines. Their employment will boost labor productivity five to tenfold and reduce the volume of

transport changes by a factor of 15. However, in the practical implementation of this work, it has become clear that legal norms regulating relations relating to the introduction of new tehnologies affect manifestly inadequately the existing system of obligations, personal interest and responsibility of associations, enterprises and their managers.

At the present time, a clear-cut legal procedure of transforming statewide targets (formulated in consolidated form) in the plans of specific sectors does not exist. Let us take, for example, the task set by Basic Directions of introducing progressive basic technologies makes it possible to boost labor productivity manifold and to radically improve quality of production output. It is planned even in the 12th Five-Year Plan to increase one and a half to two times the volume of their use.

But the practical realization of each technology calls for coordinated work on the part of organizations and enterprises of many ministries and departments. They occupy in many things a waiting, and even a defensive, position in regard to pertinent targets. Such contradictions can be eliminated. But this requires a radical change in economico-legal relationships in this sphere, making the motivation of each particip[ant in the creation of a new technology dependent on the volume (better still-the economic effect) of production output with the use of the new technology for an extended (no less than 5 years) period of use. Then the quicker and more qualitatively each coexecutant performs his functions, the sooner and more will he earn. Such an approach will be in keeping with the principles of full cost accounting and self-financing.

The transition to a mechanism of motivating creators of technology for the sake of effect obtained from the user is of basic importance. Today a significant social and economic effect for the national economy sometimes impairs planned and reporting indicators of an enterprise that is a producer of production systems. The paradox is that the less expensive production output is, the less profit does the enterprise making the new systems receive. For this reason it more eagerly embarks on technological innovations that do not require radical changes. The organization of development and the practical work of their introduction are not coordinated with each other.

For the purpose of improving incentives for creators of technology through deductions from the economic results of users' operation, it would be advantageous to develop norms (of production cost, labor intensiveness, resource intensivenesss and the like) not as part of a plan, as it has been everywhere until recently, nor "for growth," as under the new conditions of management, but "for the level." Moreover, norms must have a maximum size which could be attained with the fullest possible use of the most advanced technologies.

It is becoming increasingly clear that the integrity and balanced character of organizational legal mechanisms in the sphere of introduction counteracts the system of product certification.

It would be more useful in our opinion to carry out certification not of products but of production processes. This would significantly narrow the growing scope of work of certification commissions which is so extremely large and almost defies control. The point is being reached where it is found necessary to introduce special commissions for the verification of decisions of certification commissions. Thus in 1985 more than 2,000 decisions on awarding the State Seal of Quality were rescinded on the basis of the results of such checks. Attempts to expand in this field the rights of ministries so far have not produced the necessary result. As of 1986, a procedure was introduced of registration with organs of Gosstandart of technical conditions following expert examination by their head organizations while taking into account correspondence with top world achievements. After carrying out such registration, Gosstandart noted that only one-fifth of the registered technical conditions include indicators meeting the world level. The head organization, however, does not bear any responsibility for such actually upward distortions.

By providing ahead of time an assessment of the level of technology, it is possible to make a conclusion on the quality of production output. For example, in machine building the relative share of products of the highest category of quality amounts to about 35 percent, although there are many plants with a low technological level where it does not reach even 10 percent (Mytishchi Instrument Making Plant, Novocherkassk Production Association, Magnit Association and others).

One can hope that in the future certification of production processes will be replaced by certification of a plant's brand where an enterprise in the course of an extended time provides the highest technical level and production quality. Under present-day conditions this can be achieved only on the basis of advanced technology.

At the present time, the objective of maximal utilization of modern technologies for the production of designs of one's own development is becoming inadequate to the principle of full satisfaction of differentiated requirements of users. A seeming conflict of interests has been formed within the system of state management of the economy. This makes clear the active role of law, for the elimination of arising contradictions requires a clear orgnizational legal mechanism.

First of all, as it happens, it is necessary to exclude unjustified expansion of the list of products put out. Today ministries and enterprises try first and foremost to introduce their own designs. For example, the

tractors of the Minsk and Lipetsk tractor plants are very close in terms of working parameters, but the level of standardization of parts amounts to only 2.7 percent. The result is also unsatisfactory with respect to the use of industrial robots. They are designed, created and emplo in many sectors. This is the most simple, but from positions of the future, the least effective method of work. As a result, many models have appeared for the performance of similar work, Theey are characterized by poor standardization, low quality and high cost of each manipulator unit.

It is well known that at specialized plants with modern production processes the cost of each item of intersectoral use is threefold to fourfold lower than in the case of its fabrication at nonspecialized enterprises.

Losses solely in the production of billets, parts and components, tools and equipment of general machine-building use due to the lower level of specialization in their manufacture reach two billion rubles.

Legal norms now regulating relationships between participants of the creation process and introduction of new achievements of science and technology require for their improvement.

At a number of sectors, so-called technological centers have appeared. Thus the Scientific Production Association for Technology of Preparatory Production and Special Technological Equipment—the head technological organization of the Ministry of Heavy, Power and Transport Machine Building—will create in the 12th Five-Year Plan automated lines and pulse molding units, robotized technological complexes and flexible production systems. It is now important that in regulations concerning such formations (centers, complexes) approved by the ministries in addition to tasks and functions of an intersectoral character relating to the creation and output of new equipment rights and responsibilities are secured in regard to its adjustment, cadre training, inspection of operation. firm servicing and repairs.

Such organizations must bear the responsibility for the scientific and technical level of employed developments which it is necessary to strengthen normatively.

The establishment of adequaate economic responsibility of the client is also necessary for timely introduction of production systems.

In the work of scientific and technical centers, technological institutes and intersectoral scientific and technical complexes, one should strive for quick drawing up and introduction of technological ideas into practice. Significant experience has been acquired at the Ivanovo Machine Tool Building Production Association imeni 50-Letiye SSSR where designers, violating all existing canons, work simultaneously with technologists and production people according to the so-called comprehensive-combined method. Under these conditions, an experimental model or an introductory batch is not created as is customarily done, but the series product is manufactured immediately. The effectiveness of organizing such work is so high that a prompt review of all normative determinations hindering its rapid introduction into practice is required.

Expansion of the scale of use of new progressive technologies also depends on the organizational forms of enterprises or associations. It has already come about that the greatest effectiveness is expected of a large enterprise. Many of them actually justify such expectations.

At this time, it is important to eliminate all barriers standing in the way of creation of small specialized enterprises. This does not contradict concentration of production and development of associations or the task of liquidating small enterprises. Small specialized enterprises have at their disposal quite modern fixed capital. Very small enterprises, however, have, as shown by practice, obsolete production equipment.

At the same time, if at a small plant intended to satisfy the needs for metal products of some region, the product assortment begins to be artificially narrowed, it then is transformed from a specialized to a very small metallurgical production facility shipping its products to numerous regions of the country. The expected effect of such a plant is reduced.

The creation and development of progressive forms of associations and enterprises, especially if they go beyond the framework of departmental affiliation and territorial administrative division, is hindered by the existing awkward procedure of coordination with sectoral and regional organs. It frequently acts against inclusion in an association and loss of the independence of "its" enterprises. Such an approach contradicts technological, economic and social expediency.

A significant gap exists in planning practice between the forming of a plan aimed at major technological changes and plans of capital investment and development of production. Here one should take the well-known route of developing large programs encompassing the most advanced integrated technologiess and also use a new legal form—issuing state orders for the creation of new technologies.

Domestic experience shows that only a system of planning from the center can provide high dynamics of public production and accelerate the introduction of especially large technological innovations producing an effect in many sectors and spheres of activity.

Under the conditions of technological retooling of production, a major role is assigned to the human factor. Specialists are basically trained today by being instructed in the design of specific machines. If you take into consideration (and this is confirmed statistically) that technologies "live" much longer than specific products, such an approach becomes doubtful. In training specialists, in our view, a sharp turn must be made in the direction of studying the latest technologies and their possibilities.

The improvement of organizational legal conditions for the accomplishment of radical technological changes will be a powerful factor in the acceleration of scientific and technical progress.

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Working Group for Geotraverse Project Meets

18140147c Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 12, Dec 87 pp 82-84

[Article by Candidate of Geological Mineralogical Sciences A.G. Rodnikov under the rubric "International Scientific Relations. Brief Reports": "The Meeting of the Working Group for the Geotraverse Project"]

[Text] Since 1983 Soviet and Japanese specialists have been performing work on the Geotraverse Project, which was proposed by the Interdepartmental Geophysics Committee of the USSR Academy of Sciences.[1] In conformity with an understanding meetings of the Geotraverse working group are convened for the coordination and discussion of scientific results. One such meeting, which was organized by well-known Japanese scientist S. Ueda, was held on 14-17 March 1987 at the Institute of the Study of Earthquakes of Tokyo University. In all 4 Soviet and 16 Japanese scientists, as well as 3 Chinese specialists, who were invited by the Japanese side, took part in its work.

At the meeting the profile of the geotraverse, which passes through the North China Plain, the East China Sea, the Ryukyu Islands, the Philippine Sea, the Marianas Islands, and the Northwestern Basin of the Pacific Ocean, was specified. The length of the profile is 5,500 kilometers, the depth of the section of the tectonosphere is 600 kilometers. The director of the Geotraverse Project on the Soviet side—the author of this article—presented the results of the comprehensive interpretation of the geological and geophysical data, which were obtained on individual sections of the geotraverse, as well as the results of additional research on the profile of the geotraverse, which was performed by Soviet and Japanese specialists in the regions, where there were insufficient data for the construction of a deep profile, and specified the tasks of subsequent work. T. Siki, director of the project on the Japanese side, noted the need for the comprehensive interpretation of all the geological, geophysical, and geochemical information for the purpose of constructing a model of the tectonosphere of the transition zone. L.L. Perchuk developed a petrological model of the tectonosphere of the transition zone. He examined the origin of deep-water basins of landlocked seas on the basis of the magmatic processes, which are occurring in the depths of the earth, with allowance made for the role of volatile components, especially water.

For the first time for the region of the Philippine Sea S. Ueda with associates calculated the deep temperatures. The isotherm of 1,200 degrees Celsius under the West Philippine Basin is located in the upper mantle at a depth of 75 kilometers, which approximately coincides with the zone of high conductance, which was identified here by N. Isezaki. Under the Parese-Vel Basin this isotherm rises to a depth of about 40 kilometers, while under the Marianas Trench it penetrates the earth's crust.

P.A. Stroyev displayed a map with the routes of gravimetric measures, which were laid by Soviet expeditions in the zone of the geotraverse in the Philippine Sea. A model of the density heterogeneities of the tectonosphere along the profile of the geotraverse was constructed on the basis of these data. K. Tamaki presented diagrams of the gravimetric radiation of the geotraverse in the Philippine Sea, N. Fujimoto (Japan) presented them on the Ryukyu Islands and in the East China Sea.

The density distribution along the section of the earth's crust and the upper mantle of the Marianas ridge and trench was discussed at the meeting. These data were obtained by gravimetric and seismic methods. The residual anomalies of the gravitational forces in the region of the Marianas Trench, which come to -150 to -200 milligals, testify that the matter of the upper mantle is less dense here than under the deep-water basins of the ocean. The dimension of this dispersed lens horizontally is 200 kilometers and vertically is 100-150 kilometers with a depth of its submergence of up to 200 kilometers.

In accordance with the data of gravitational measurements, which were made by Chinese expeditions in the East China Sea, a map of the Buge anomalies was drawn for the region, which extends in latitude from Taiwan to Cheju and Kyushu islands, and in longitude from the shores of China (the city of Shanghai) to the island arc and deep-water trench of Ryukyu. The map supplements the gravimetric data, which were obtained by Soviet specialists in the East China Sea and are cited in "Gravimetricheskiye karty Vostochno-Kitayskogo morya. Anomalii v svobodnom vozdukhe i Buge. Mashtab 1:2000000" [Gravimetric Maps of the East China Sea. Anomalies in the Open Air and Buge. A 1:2000000 Scale] (1985).

The research, which was conducted in the zone of the geotraverse in the Okinawa Basin of the East China Sea, proved to be very important. The structure of the basin was studied in detail, its rift nature was established. On the basis of geological and geophysical data, as M. Kumura reported, it was established that the Okinawa Trench underwent riftogenesis about 2 million years ago, although, perhaps, the tensile stresses began back during the Miocene (about 25 million years ago). A rift structure, in which various effusive rocks were dredged, is traced along the axis of the basin. A high heat flow was noted. The thickness of the earth's crust here decreases to 15 kilometers. K. Nemoto depicted a section of the earth's crust of the Marianas Island arc and the adjacent section of the Pacific Ocean (to 150 degree east longitude). N. Isekazi showed the distribution of magnetic anomalies along the profile. The linear magnetic anomalies are clearly delineated in the deep-water trenches of the Philippine Sea in regions of the development of rift structures. U. Isikava showed individual seismic sections and sections of the focal zones.

On the territory of China the profile of the geotraverse passes through the North China Plain, which is located on an ancient platform. In recent times extensive geological and geophysical studies of the deep structure of

the earth's crust and the upper mantle have been conducted here. The Chinese scientists delivered reports on the geological and seismic studies of the crust and upper mantle along the profile of the geotraverse.

The Chinese Precambrian platform during the Cenozoic era experienced tectonic activity. Over several ages in the processes of stress intracratonal troughs formed. In the geological history of the platform three stages of magmatic activity are distinguished: the Paleogene (66-28.5 million years ago), the Neogenic period (25.42-2.6 million years ago), and the Quaternary period (from 2.5 million years to the present). The system of troughs, which controls the magmatic rock, is expressed in the deep structure by the decrease of the thickness of the crust and the lithosphere, by a heat flow, and by the localization of seismicity. The asthenospheric layer is located under the North China Plain at a depth of approximately 50 kilometers and is traced according to the data of seismic sounding to a depth of 100 kilometers. The highly conductive layer (a resistance of several ohms) in the upper mantle coincides with the asthenospheric layer. A highly conductive layer is also distinguished in the crust at a depth of 15-17 kilometers.

The Chinese scientists—Liu Guodong (the Institute of Geology of the PRC State Seismological Bureau), Xiong Shaobai (the Institute of Geophysics of the PRC Academy of Sciences), and Zhou Dashou (the Bureau of Petroleum Geology and Marine Geology of the PRC Ministry of Geology and Mineral Resources)—expressed interest in the work on the Geotraverse Project.

K. Tamaki, representative of Japan on the International Commission for the Lithosphere Program, reported on a new project of this program, which is called Global Geoscience Transects. The construction of a series of deep sections in terms of the basic structural elements of the earth is envisaged by the project. The geotraverse of the Philippine Sea, in the conducting of which Soviet and Japanese scientists are participating and Chinese specialists will probably take part, can be included as a component in the new project.

The comprehensive interpretation of the geological and geophysical data, which is being performed within the Geotraverse Project, envisages the study of the correlation of surface and deep structures, the geodynamic peculiarities of the stressed state of the earth's crust, and the dynamic models of the tectonosphere of the transition zone. The construction of the geotraverse will contribute to the more careful forecasting mineragenic evaluation of the region.

The meeting of the working group laid the foundation of businesslike scientific cooperation on the Geotraverse project between scientific institutions of the USSR, Japan, and the PRC. In the adopted resolution the directions of subsequent research were outlined and recommendations on the implementation of the Geotraverse Project in the set time were formulated.

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International Ionosphere Information Seminar

18140147b Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 12, Dec 87 pp 80-82

[Article by Candidate of Physical Mathematical Sciences T.L. Gulyayeva, Doctor of Physical Mathematical Sciences G.S. Ivanov-Kholodnyy, and Corresponding Member of the USSR Academy of Sciences V.V. Migulin under the rubric "International Scientific Relations. Brief Reports": "The 1st International Seminar on Ionosphere Information Science"]

[Text] Ionosphere information science is a new scientific direction, which originated at the meeting point of ionosphere research and information science. In contrast to neutral clouds of the earth's atmosphere the ionosphere as a conducting medium is accessible to remote methods of study by means of radio engineering aids, which are installed on earth or on board spacecraft. First order representations of the very object of study—the model of the ionosphere—are of extremely great importance for the proper interpretation of the results of such research. The development of means of information science made it possible to form a software image of the ionosphere on a computer and to subject it to tests by the method of numerical experiments instead of and along with more expensive direct methods of studying this portion of near-earth space.

The goal of the 1st International Seminar on Ionosphere Information Science, which was held in May 1987 in Novgorod, was to specify the group of questions, which pertain to this subject, to evaluate the world level of research and the contribution to it of Soviet scientists, and in the end to stimulate the efforts in the necessary directions of this field of science. In all 120 people from 11 countries, including representatives of the International Scientific Radio Union (URSI), the Committee for Space Research (COSPAR), the USSR Academy of Sciences, the RSFSR Ministry of Higher and Secondary Specialized Education, the USSR State Committee for Hydrometeorology and Environmental Control, and other organizations, participated in the work of the seminar. The reports made at the seminar (there were about 70 of them) will be published in the COSPAR journal ACHIEVEMENTS IN SPACE RESEARCH.

Ordered papers, brief reports, and stand papers with respect to the four sections: systems of the analysis of experimental data, bases of ionosphere data, the modeling of the ionosphere, and the International Reference Ionosphere (IRI), were included in the program of the seminar. With respect to the first section Soviet scientists presented the majority of the reports (18 of 24), inasmuch as in contrast to our country the stage of the development of automated systems of the analysis of

experimental data has already been covered abroad. The reports with respect to the remaining sections of the program were distributed uniformly among the countries.

Ground and satellite methods of the remote probing of the ionosphere, systems of real-time digital ionosondes, and the method of incoherent scattering were examined in detail at the seminar. At present the network of ionosphere stations of vertical sounding numbers about 150 ionosondes, which operate around the clock every 15 minutes, of them about 50 are digital ionosondes with a small computer. In the next few years, B. Reinish (the United States) reported, the installation of another 30 Digisond-256 digital ionosondes, which make it possible to calculate the profiles of the electron density of the ionosphere in real time, is planned.

The possibilities of obtaining results of the analysis of digital ionograms in real time will make it possible to use simplified methods of their interpretation. This will require the filtering and correction of the results of the analysis in case of their introduction in software models of the ionosphere. The methods of the analysis of the profiles of electron density in accordance with ionograms of vertical sounding have been used for a long time and effectively in our country, and the results of such an analysis for many ionosphere stations in the USSR, as well as in other countries—Argentina, Belgium, the GDR, India, the United States, and France—were presented at the seminar.

The world network of stations of incoherent scattering is an order smaller than the network of stations of the vertical sounding of the ionosphere, and the incoherent scattering units operate approximately a day a week. By means of them substantial results were obtained on the energetics of the ionosphere (the budget of energy of electrons, flows of photoelectrons), the structure of the thermosphere (systematic variations of the temperature, density, and composition), and the dynamics of the upper atmosphere (the general circulation, gradients, and gravitational fields). At three stations of incoherent scattering—at Aresibo, EISCAT in Northern Scandinavia, and Kharkov—there are stands for the artificial modification of the ionosphere by powerful shortwave radio frequency radiation. The results of the observations at the stations in Scandinavia and Kharkov were presented at the seminar (T. Turunen—Finland, V.I. Taran—the USSR).

The planning and subsequent analysis of active experiments are impossible without a reference image—the reference model of the ionosphere. The global network of patrol stations of vertical scattering, which makes it possible to carry out the diagnosis and forecast of the degree of activity or perturbation of the ionosphere, should serve these goals. A resolution on the start of coordinated work on the data of stations of vertical sounding and incoherent scattering was adopted at the seminar.

The difficult situation with the development of bases of ionosphere information in our country appeared with all obviousness at the seminar. Theoretically there are no obstacles to the development of such databases in machine-readable form, since at the leading scientific institutions there are both powerful computers and skilled staffs of programmers. There are as if no obstacles as well to the exchange of such data through the system of world data centers, especially as 30 years of experience of exchanging data of the regular patrolling of the ionosphere have been gained. Nevertheless bases of ionosphere data for computers have not been prepared by either the Academy of Sciences or the USSR State Committee for Hydrometeorology and Environmental Control, although, for example, in the field of geomagnetic research there are developments on the changeover to databases on computer media. The references to the obsolete equipment of the network of ionosphere stations and the lag with the introduction of digital ionosondes in this network cannot serve as justification—it is well known that it is easier to ruin any work that to develop it. The results of the remote methods of patrolling the ionosphere, which are being developed throughout the world, are gradually becoming less and less dependent on the data supplied for exchange, but for global scientific research in geophysics one should retain this exchange and change over to the presentation of information in a form that is convenient for computers, as is being done in all countries.

All aspects of the empirical and theoretical modeling of the ionosphere, the interrelations of ionosphere models with the flows of observation data, the role of solar, geomagnetic, and aeronomic control parameters in the determination of the state of the ionosphere (G.S. Ivanov-Kholodnyy—the USSR, Rastogi—India), the mathematical description of ionosphere profiles of the electron density (K. Raver—the FRG), and the breakdown of fields of ionosphere characteristics by orthogonal functions (N.I. Dvinskikh—the USSR, B. Reddi et al.—India) were reflected in the reports at the seminar. Second-generation ionosphere models, so-called semi-empirical or hybrid models (V.M. Polyakov), seem most promising, since the basic traits of the determinate (theoretical) approach with adaptation to experimental data are synthesized in them. Work on the modeling of the ionosphere is being performed intensively in all countries and is discussed almost annually at ionosphere conferences in our country and abroad.

At the seminar the question of establishing a machine-readable catalog of publications on ionosphere themes as the basis of a knowledge base was raised for the first time and a resolution on the inclusion of the catalog together with key words in the software system of the International Reference Ionosphere was adopted. A systems analysis of the knowledge base on the ionosphere (T.L. Gulyayeva—the USSR) and a detail analysis of the sources of information on the ionosphere on the basis of materials of the World Data Center for Rockets and Satellites (D. Bilitsa—the United States) were presented at the seminar.

The seminar participants familiarized themselves with the research on the automation of the processing of ionosphere data, which is being conducted by the group of G.M. Yemelyanov at Novgorod Polytechnical Institute.

It is planned to hold the next seminar on ionosphere information science and empirical modeling during the work of the regular COSPAR assembly in Helsinki in 1988.

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Velikhov Speech to Party, Economic Aktiv of Academy of Sciences

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[Speech by Vice President of the USSR Academy of Sciences Academician Ye.P. Velikhov at the meeting of the party and economic aktiv of the USSR Academy of Sciences on 9 September 1987 under the rubric "The Party and Economic Aktiv of the USSR Academy of Sciences": "On the Tasks of the USSR Academy of Sciences in Light of the Decisions of the June (1987) CPSU Central Committee Plenum. The Report of Vice President of the USSR Academy of Sciences Academician Ye.P. Velikhov"]

[Text] The decisions of the June CPSU Central Committee Plenum are playing an enormous role in the implementation of the new economic strategy of the party, which was endorsed by the 27th congress. The Law on the State Enterprise and a number of documents on the restructuring of planning, pricing, finance, banking activity, material and technical supply, state statistics, the work of organs for labor and social problems and the USSR State Committee for Science and Technology, the activity of sectorial ministries and territorial organs, and the work of the staff of the Council of Ministers were adopted on their basis.

In conformity with the directives of the plenum as of 1 January 1988 the enterprises and associations of 20 ministries, including all machine building ministries, the ministries of the petroleum and gas industries, nonferrous metallurgy, the timber complex, the chemical and medical industries, all types of transport, and other sectors, are being changed over to full cost accounting and self-financing. The following year about 60 percent of all industrial enterprises will operate under the new economic conditions. Much work is being performed in the country on the repeal of all obsolete enforceable enactments, which are at variance with the Law on the State Enterprises and the adopted decrees. Restructuring has been started in central economic organs, ministries, and republic organs. The master plans of management are being revised, superfluous units are being eliminated. It is proposed to reduce the management staff by 30-50 percent.

The credit system is being reorganized, banks are being changed over to cost accounting, a number of new banks for more specialized service have been established. The reform of pricing and finance and the extensive changeover from centralized material and technical supply to wholesale trade are being prepared. The task is being posed to sell by 1990 by way of such trade 60 percent of all the means of production and in 1992, 80-90 percent. It is necessary to complete this work in the next 3 years, in order to enter the 13th Five-Year Plan with a new economic mechanism and to approach in a new way the drafting of the five-year plan.

The essence of the decisions of the June Plenum consists in the changeover from the administrative system of management, which formed in the past, to a new integrated system, which is based on economic methods and extensive democratism and on the consideration of the economic interests of labor collectives. These decisions envisage the elimination of the mechanism of deceleration and the dictation of the producer over the consumer, the subordination of production to social needs, the stimulation of the increase of the efficiency of labor and product quality, the acceleration of scientific and technical progress, and the creation of favorable conditions for social development. At the plenum it was stressed that the restructuring of management is an important condition of the solution of all other economic problems. The new integrated system of management should constitute the basis of the mechanism of acceleration, which will provide us with the doubling of the pace of economic growth and will bring our country to the most advanced levels.

The decisions of the June CPSU Central Committee Plenum pose the most important tasks for Soviet science as a whole and for the USSR Academy of Sciences. These are, first, the restructuring of management in the system of the Academy of Sciences and the development of the democratic traditions of the academy in conformity with the general directions of the democratization of all Soviet society and with the decisions of the January and June CPSU Central Committee Plenums; second, the extensive introduction of competitive principles in the scientific and technical sphere—a task which was posed in the report of M.S. Gorbachev at the plenum; third, the development of a mechanism of the more extensive introduction of the achievements of science in practice; fourth, the decisive acceleration of the work on key programs, including in the area of the social sciences and economic science, which are connected with the fulfillment of the tasks posed by the plenum.

I will begin with the question of the introduction of the competitive principle of the allocation of resources and the evaluation of results and of the mechanisms of the

effective stimulation of innovations. At present allocations for the most part are of a nonreturnable nature, assets are allocated from the budget, in conformity with the level achieved for the institution as a whole. The themes of the institute and the success or failures in the development of individual directions of research have a very weak effect on the scale of financing. Often a mandate for the determination of what is the scientific truth and for the self-evaluation of the results is also presented de facto to the scientific subdivision, to which some theme has been assigned. Such a subdivision becomes a monopolist in science and strives to preserve such a situation, hindering in every possible way the development of ideas that appear outside its walls. At times this is also called coordination. Hence often there are also megalomania, the inflation of themes and projects, the loss of flexibility of the organizational structure, and the artificial support of directions that have exhausted themselves. Under these conditions it is practically impossible to redistribute the potential of science and to achieve its intensification. At the plenum M.S. Gorbachev particularly directed attention to the fact that "the monopoly position of individual organizations is seriously hindering scientific and technical progress and is developing for society into large losses." It is difficult to immediately suggest ready-made formulas. But it is possible already now to express several views in this regard, by relying on world experience, including the experience of the socialist countries.

To start with it is possible to distribute on a competitive basis a certain portion, for example, a half, of the budget assets which are being allocated for the development of basic science. It is possible to accept applications for financing from individual scientists, from groups, and from organizations. The decisions on the allocation of assets should be made on the basis of an independent evaluation that is made by scientists—precisely scientists, and not any staff whatsoever. Here it is inadvisable to regulate the breakdown of the allocated assets by individual items of expenditures and the organization of research work. It is possible to carry out the monitoring of the effectiveness of the spending of the assets on the basis of the analysis of the reports on the results of research, the tracking of publications, and the frequency of quotation. In the United States more than 50,000 scientists annually participate in such expert work and $1.5 billion are distributed through this mechanism. Of course, such work takes much time and one must not perform it at odd moments like public work or simply assign it to some bureaucratic staff or our councils.

If such a mechanism is adopted, the resources, which are allocated to each institute, would be formed from the assets, which are allocated for the fulfillment of the basic assignments in accordance with the decision of directive organs, from the assets, which are distributed by the department of the academy for the fulfillment of its basic scientific programs, which support the scientific traditions of the academy, from the assets, which are obtained by individual program collectives through competition, and, finally, from the receipts from economic contracts. Adjustments should be made in the statute on the latter in the spirit of the decisions of the plenum, on the basis of the gained experience, particularly the experience of the Institute of Nuclear Physics of the Siberian Department. This institute develops, produces at a pilot enterprise, and delivers to industry so-called industrial accelerators, which are being successfully used for the production of cable insulation and a number of other purposes. In recent times the institute has been developing and delivering sources of radiation for large systems in a complete set. In contrast to the previously established practice the clients do not pay the institute for expenses in conformity with the estimate, but purchase its products at contract prices. This enables the institute to use a portion of the received assets for the conducting of basic research and for the development of production and the social sphere. By taking such opportunities, it is possible to increase more the stimulating role of the additional revenues, which academic institutes would derive from the extensive use of their achievements in practice. Here it is necessary to think out a system of the stimulation of scientists both for the obtaining of basic results in science and for the successful completion of contractual operations. Such a system should envisage the transfer of a portion of the earned assets for the development of basic research. Here it is necessary to increase sharply the economic responsibility of institutes, as it is envisaged to do with respect to organizations of applied science. It is necessary, in particular, that the earned money would be spent freely for research work in the most different forms. If, for example, in the United States or another capitalist country a group of researchers receives $1 million for a job, depending on the needs it can additionally hire scientists for work through the combining of jobs or for temporary work, purchase the necessary equipment, lease space, pay the expenses of an outside organization, and so on. In our country now the obtaining of an additional million in itself still means not much. It is necessary to get the limit of personnel, to submit an order for equipment, to drum up and obtain currency, to acquire space, and so on. The energy of scientists, who want to develop their own work, to a significant extent is also spent on all this. It is possible and necessary that it would be possible to back the additional money with everything necessary. For this it is necessary to change over to real wholesale trade and to place the material supply of science in a privileged position, to change the regulations of the planning of labor and the wage, to establish a coefficient of the free convertibility of the ruble into foreign currency with respect to the sphere of science, preferential construction for the money, and so on. The spending of the academy holds such a negligible place in the total spending of the state that such steps will not create any additional difficulties, while the gain in efficiency of the national economy can be appreciable.

The flexible economic legal mechanism should permit a wide diversity of organizational forms, it is necessary that the organizational form would be fit to the task, and

not the task would be crammed into the Procrustean bed of an ossified form. In particular, it is necessary to use more extensively the forms of the temporary organization. We already have some experience here. In 1981 such a form as temporary scientific and technical laboratories, which were established for a period of 3 years, was proposed. There was set for these laboratories the task to expedite the the practical implementation of the results of the scientific research of the institutes, at which these laboratories had been organized. The experiment proved to be successful. The comparatively great efficiency of such a form of the combination of the efforts of collectives of the academy and enterprises was demonstrated, the implementation of research results was sped up substantially. According to estimates of the academy, the State Committee for Science and Technology, and other organizations, the introduction of scientific research was sped up by 1.5- to 3-fold.

Taking into account the positive results of the experiment, the USSR Academy of Sciences addressed to the USSR State Committee for Science and Technology a proposal on the further development of this form of the organization of research. During 1986-1987 the Presidium of the USSR Academy of Sciences made the decision on the organization of 43 temporary scientific and technical laboratories. They were organized at institutes of three sections of the Presidium of the USSR Academy of Sciences, the Siberian Department, and the Ural and Far Eastern departments and at institutes of the Kazakh SSR, Georgian SSR, Lithuanian SSR, and Estonian SSR academies of sciences. These decisions were made in accordance with the suggestions of departments of the USSR Academy of Sciences and interested ministries and departments. The problems were selected with allowance made for the prospects of the use of the results, the level of development at the corresponding academic institute, and the possibilities of the pilot production of items.

The majority of new laboratories have been operating for only about a year, and a number of results have already been obtained. For example, the Institute of High Temperatures established a laboratory for high-temperature and power technology processes. This made it possible in a short time together with the Ministry of Ferrous Metallurgy to develop and produce at two plants large power technology complexes. The Institute of Problems of Mechanics in 16 months designed and produced the 6-kilowatt Lantan-3 compact laser unit. At present life tests of this unit are being conducted and the operating documentation has been prepared. At the Institute of Applied Mathematics a package of applied programs for the automation of the technological preparation of the production of turned parts on machine tools with a microprocessor control system, which makes it possible to increase substantially the labor productivity of the process engineer and, in particular, to free him from the making of complicated geometric calculations, was developed, was implemented on a computer, and was turned over to the client. Four laboratories were established at the Institute of Metal Physics of the Ural Department. Here a device for the checking of magnetic layers in the process of the production of magnetic information media was developed and prepared for production. Units for the checking of the quality of seams of electrically welded pipes, the welds of drill pipes, and the butt joints of underwater gas pipelines and offshore fixed platforms have been produced and are being introduced at a number of industrial enterprises.

Of course, certain difficulties and drawbacks of this form have also come to light. Moreover, life is advancing very rapidly, and, in developing the network of temporary laboratories, it is also necessary to seek new forms of the organization of research, development, and the introduction of results. One such form is temporary scientific and technical collectives, about which G.I. Marchuk spoke. For the present we do not have that many of them. One of them is the Start Collective, which was established in March 1985 for a period of 3 years. Five base organizations of the USSR Academy of Sciences, the Siberian Department of the USSR Academy of Sciences, the Estonian SSR Academy of Sciences, the Ministry of Instrument Making, Automation Equipment, and Control Systems, and the Ministry of the Electronics Industry are represented in it. The collective is relatively small—about 200 people. The development of mockups and prototypes of parallel multiprocessor computers and intelligent system software was assigned to it. Scientific groups of Novosibirsk and Moscow universities were enlisted in the work, contracts on scientific and technical cooperation and the introduction of developments were concluded with enterprises of a number of ministries. During these years very interesting developments have been devised: high-performance computers for scientific calculations with a speed on the order of 20 million operations a second; a multiprocessor transcomputer system of a modular evolutionary architecture of the mini-super class; the Kronos family of high-performance (up to 2 million operations a second per processor) systems of an advanced architecture and a series of microcomputers and work stations based on them. A collective, which is capable of solving difficult complex problems, was established.

The second problem, which in accordance with a decision of the USSR Ministry of Education, the USSR State Committee for Science and Technology, and the Academy of Sciences we are also solving by means of a temporary collective under the scientific supervision of Academician A.P. Yershov, is connected with the computerization of school education and the development of programs of educational processes. The work in practice began on 1 September of this year, when 25 experimental schools were singled out, but results have already been obtained: the course "The Principles of Information Science and Computer Technology" for the 9th and 10th grades, which for the present is the only one in the world, was developed, a comprehensive concept of the use of computers in the educational process in elementary

school, a computer instruction medium for the study of the native language and mathematics, a system of assistance to lagging children, and so on were developed and are being implemented. All this is being done on the basis of the Shkola Temporary Scientific and Technical Collective. The basic components of the programs of "computer universal education" of workers of public education have been developed, the transfer of programs to serial school computers, which satisfy the requirements of the Ministry of Education, has been prepared, the educational psychology principles of the system of leading education are being studied, new educational courses in all school subjects, in which routine information has been reduced and the achievements of individual fields of modern science and social practice have been integrated, are being developed.

It must be said that the scientific and technical potential of higher educational institutions is being used in the temporary scientific and technical collective, Moscow State University and the Moscow Power Engineering Institute are participating in its work. Cooperation with Bulgaria, where very interesting experience in this matter exists, and with leading centers of the United States, Italy, and a number of other countries has been organized.

In March 1986 a temporary collective for the development of equipment of the nondestructive testing of electrical steels was established at the Ural Department. In all 11 basic organizations from 4 ministries and the Academy of Sciences are represented in it. Thus far the technical assignments have been formulated and approved, the fundamental questions of the arrangement of the units have been settled, and mockups of individual blocks have been produced and tested.

Another temporary collective was established by the Ural Department for problems of high-temperature superconductivity. Its work on the synthesis of high-temperature superconductors and the comprehensive study of their physical properties received a high rating at a large number of conferences in the country and abroad.

Special organizational forms are needed for the solution of the most difficult problem—the notorious problem of introduction. It is natural that the new economic mechanism should made industry receptive to innovations, and then the old forms—economic contracts and sectorial laboratories—will also receive new life. At the same time it is also necessary to take into account the experience of more effective forms of the cooperation of science with production.

One of the main problems in bringing an idea up to a product consists in the fact that 10 rubles, which it is necessary to spend on development, and 100 rubles, which it is necessary to spend on the organization of production and the study and development of the market, that is, on the commercialization of the results of research, fall to every ruble of expenditures on research. How is this chain to be organized, so that it would operate quickly and, what is the main thing, continuously, without losses? Often either the academy cannot ensure development and commercialization or industry says: If we bear 90 percent or even 99 percent of the expenditures, what do we need your ruble for? Thus we lose in embryo the quality of a new product.

We have some experience here. Thus, Academician V.A. Melnikov is simultaneously the director of the Institute of Problems of Cybernetics of the USSR Academy of Sciences and the chief of a department of a ministry. In this capacity he deals with the development of high-performance computers, on which we are counting as one of the main computers for computer-aided design systems and for scientific research. Owing to this it is possible to use the possibilities of basic developments, which are being afforded owing to the cooperation of the academy with more than 50 plants.

Another means is the establishment of joint centers. Just recently an entire institute of computer-aided design was actually established on the basis of the center of the Plant imeni I.A. Likhachev. The Bureau for Machine Building of the USSR Council of Ministers is placing great hopes on this center in the development of an integrated system of computer-aided design and the automation of engineering labor. Moscow University is actively participating in its work, and research is being directly combined with education: third-year students come to the plant and work with excellent computer hardware.

The academy established the same kind of center jointly with industry for the designing of very large integrated circuits. Definite gains have already been achieved there.

Of course, interbranch scientific technical complexes are a more large-scale solution, but for the present not everything here is easy with them. One of the most important interbranch scientific technical complexes for the Academy of Sciences and for the country is the Nauchnyy pribor Interbranch Scientific Technical Complex. Institutions of the Academy of Sciences and the Ministry of Instrument Making are united in it. As a whole the work is going smoothly. Although the increase of the resources and capacities of this interbranch scientific technical complex is faced with certain difficulties, nevertheless we should increase by 1990 the volume of output of scientific instruments at the academy to 100 million rubles a year and as a whole to 300 million rubles, and in so doing should achieve a high quality of the instruments being produced and quickness of their development.

The problems with other interbranch scientific technical complexes are more complicated. Take if only technological lasers. We might not have established this interbranch scientific technical complex at all, if the electrical equipment industry would have fulfilled the adopted

decisions and would have completely ensured the development of lasers—there are no scientific difficulties here. We were in the lead in this field 10 years ago and were pleased with our successes. But during this time the leadership was lost, because the electrical equipment industry did not develop this work and now, as before, is opposing the establishment of the interbranch scientific technical complex. It is opposing not formally, but in essence, that is, it is attempting to dismantle it and to place the questions of the development of instruments, the organization of production, and so forth under its exclusive control, having separated them from research and development. Unfortunately, this situation dragged on, and, despite the great expenditures of resources, the interbranch scientific technical complex thus far is not fulfilling the plan.

The tasks with respect to the development of personal computers are enormous. Here the problem is somewhat different, because the interbranch scientific technical complex unites several ministries. Work is being developed slowly. The choice of types of computers and the very organization of mass production lag substantially. Unfortunately, the base of the complex is weak, and as a whole it thus far remains a certain conglomerate of enterprises of four ministries.

The new economic mechanism is affording certain prospects for the development of interbranch scientific technical complexes. We should increase the influence of the Academy of Sciences through the forming system of economic management. But, of course, it is impossible to manage with just these forms.

As President of the USSR Academy of Sciences Academician G.I. Marchuk has already said, while advancing our developments into industry, we should also not neglect international cooperation. Until now we believed at times: Why turn an academic development over to another country, when our industry could fulfill it? Of course, here state interests should be taken into account first of all, but the experience that we have testifies that precisely such "isolationism" is often at variance with state interests. Take as an example the gyrotron, which was developed under the supervision of Academician A.V. Gaponov-Grekhov in Gorkiy. Although our developments for some time were most advanced, the discussions dragged on, and we never appeared on the world market—this market was grabbed by a number of firms. So gyrotrons exist abroad, but we lost the market and lost the opportunity to acquire currency. But the presence of our country on the market of "high technology" is a most important task which was posed by the plenum. And it is possible to cite quite many such examples. Therefore, every time the most careful analysis is necessary.

The establishment of joint production with foreign firms is attractive in many respects. Now a group of small firms from Hamburg has turned to us with such proposals. In February these proposals were discussed with the institutes of space research, radio electronics, and general physics. As a result a number of areas of cooperation were outlined: space equipment and technology, medicine, information processing, laser equipment and technology, including fiber optic elements. As an example it is possible to cite the small mass spectrometers for the counting of particles, which were developed at the Institute of Space Research, the dynamic radio thermograph—an instrument for the determination of the three-dimensional distribution of temperature in the total volume of the human body—which was developed at the Institute of Radio Engineering and Electronics, and so forth. A meeting of a Soviet delegation with this group for the first steps on the practical realization of a joint firm is proposed at the end of November.

But all these forms are not yet ensuring the unimpeded transfer of our scientific developments to industry. As is known, throughout the world, and first of all in the United States, the establishment of what are called "venture firms"—small firms, at which the very author of some system or idea begins to directly bring it up to a final product—is the most widespread form of the implementation of innovations.

The stimulation of such small collectives, the work of which promises a large gain, for us is exceptionally important. Personal computers and many other innovations appeared in the world in precisely this way. Of course, for the present we do not have such an environment.

Today if a scientist attempts to cross the boundary between science and production, he gets into an unfriendly, hostile environment. We have discussed such examples many times at meetings of the Presidium of the USSR Academy of Sciences. We heard, for example, a report on the development of a virus-free potato, which was done at the academy. But the collective, which did this, is being torn away from further introduction and development, and everything has to be started over again in some other department. Of course, this break is exceptionally unpleasant for us, it is necessary to seek some solutions and to look at the experience of the socialist countries. In Bulgaria, for example, there is a special bank, which issues credit, including in foreign currency, for the organization of small collectives and small enterprises for the production of the latest products, first of all those which find an export market. In Hungary there is also a similar bank for the extension of credit for scientific and technical developments, which has done much for the introduction of innovations. Taking into account that the restructuring of the banking system is under way in our country, we apparently also need to think about this problem. This question, of course, goes far beyond the academy. Here first of all our economists need to think. But this problem faces us.

In the report of M.S. Gorbachev it was indicated that one of the next CPSU Central Committee plenums will be devoted to the examination of the conception of the 13th

Five-Year Plan. Institutions of the Academy of Sciences are taking a most active part in the preparation of this conception, formulating together with the State Committee for Science and Technology the Comprehensive Program of Scientific and Technical Progress. The time of the preparation of this comprehensive program has been shortened and, what is the main thing, new demands are being made on it.

The 13th Five-Year Plan will be the first five-year plan with the new economic mechanism. During the current five-year plan a significant portion of machine building will be modernized, nearly half of its products will be updated, and the extensive retooling of all sectors of the national economy will be started. A enormous reserve is being created for the 13th Five-Year Plan. It is necessary that it would become a five-year plan of the obtaining of the ripe fruits from restructuring. This should be a five-year plan of a fast pace of updating and the rapid increase of productivity and all other indicators of efficiency and a five-year plan of high levels and a high competitive ability with respect to product quality. Finally, this should be a five-year plan of major social changes.

All this requires thorough substantiation. The decision was made that the USSR State Planning Committee would submit the draft of the conception of the five-year plan to the USSR Council of Ministers together with the Academy of Sciences. At a joint meeting of the collegiums of the USSR State Planning Committee and the State Committee for Science and Technology and the Presidium of the USSR Academy of Sciences major tasks on the thorough scientific substantiation of the problems of the 13th Five-Year Plan and the long-range future were assigned to the Academy of Sciences. This is an urgent task of all the institutes that are participating in the work. I would like to dwell in this connection on two problems which, so it seems to me, are now checking to a significant degree the development of both the national economy and science.

The first is the problems of energy conservation. The 27th party congress posed the task to reduce the power-output ratio of the national income by 1990 by 7-8 percent and by 2000 by 40 percent. If we do not achieve this, we will have to increase substantially the production of fuel and the generation of power, while it is well known what difficulties this involves. However, during the 11th Five-Year Plan the plan of energy conservation was fulfilled by only 68 percent. Moreover, the pace of energy conservation is decreasing. The assignments are constantly not being fulfilled by practically all departments and councils of ministers of the union republics. It is no longer possible to explain this only by the lack of discipline and inattention. There are real reasons for the nonfulfillment, which are connected with mistakes in planning and management. This is first of all the planning for all ministries of the saving of fuel and power without regard for the necessary resources.

A simple calculation shows that if by 1990 we want to save 200-300 million tons of standard fuel, in terms of newly produced fuel the saving will come to nearly 80 billion rubles. But even if it is achieved by the most effective method—by the commitment of secondary energy resources, the work all the same will cost one-fifth of the saved amount. But resources are allocated at the level of 0.5 percent of the total capital investments. The program should be organized realistically. Saving occurs due to the development of new, energy-saving technologies. But their development and the production of the corresponding equipment require resources. Although it is a matter, of course, not of resources alone, but also of the fact that machine building ministries in practice have been not involved in the task of energy conservation. In the indicators of these ministries the saving of energy is of negligible importance: an overwhelming portion of the equipment being produced is developed without regard for the requirements of energy conservation. The situation is even worse with specific energy-saving equipment—there are no client, no developer, and no producer for it. As a result due just to the lack of supply with instruments and control systems we, according to estimates, are consuming in excess approximately 80 million tons of standard fuel. Finally, the groundlessness of the prices for fuel, which has already been spoken about in the report, is simply not conducive to energy conservation.

At the same time the potential of energy conservation is enormous. For 4 years the academy has been conducting a joint research program with scientists of the United States, Sweden, and Brazil and has been studying the experience of these countries. This is very impressive experience. In the United States major resources have been invested in energy conservation—while the Carter Administration was in power, the federal government alone invested more than $2 billion in the development of energy-saving technology. As a result the power-output ratio of the national income decreased by one-third. The analysis shows that for the support of the average standard of living of developed countries, such as Sweden, in case of the implementation of advanced energy-saving technologies and equipment the power capacities of the consumer cannot exceed 2.5 kilowatts per capital, of them 20 percent are in the form of electric power. We already have this, and if we would use advanced power technologies, we could actually stop at this. We come again to the fact that we will generate more power than anyone, but will use it worst of all. We must change over in the shortest time to a realistic energy-saving policy.

One must not base it on the sectorial principle and nonreturnable financing. It is necessary to ensure it a comprehensive, interdepartmental nature and self-support [samookupayemost]. The cost of the unclaimed fuel for the ministry, which is the user of energy-saving technology, could be the source of such self-support [samookupayemost], the amount of fuel, which has been left for the state, could be the gauge of saving, while credit could be the basic form of financing.

The Energy Commission of the Supreme Soviet is proposing to establish for the assurance of a unified energy-saving policy and the elimination of interruptions in the "development of technology—development of equipment—mass production" cycle the Energosberezheniye Special Interdepartmental Scientific Technical Complex. In principle this problem has been repeatedly considered, including in the Physical Technical Problems of Power Engineering Department. It deserves that its solution be insisted on and that it be included in the Comprehensive Program.

The second problem, which we have neglected for decades, is the development of microelectronics. A number of most important decisions, which are aimed at the acceleration of the development of domestic computer technology and its introduction in all types of activity: production, management, education, medicine, culture, and so on, have been made in recent years. Successful developments exist, very talented designers and production workers have appeared. Society is ready and is waiting for computers. But the base of microelectronics and the production of microcircuits, which are in the greatest demand, is not meeting either domestic demand or the needs of the CEMA member countries. One of our most significant problems, which are complicating cooperation with them, is the base of microelectronics. It is necessary to take into account both the latest achievements and the trends of development in Japan and the United States.

First of all the problem is due to the acute shortage of equipment and special materials, which correspond to the advanced technology of the development and production of microcircuits. The capacities of the organizations, which develop and produce technological equipment, do not conform to the tasks of the rapid development of our microelectronics and the required pace of modernization. The production volume comes to approximately 10 percent of the production of similar equipment in the West, but in level it is substantially inferior to foreign equipment. As a result in logic circuits and in "memory"—these most fundamental works—we lag by two generations. Now we have a shortage of 64-kilobyte media, in the world megabyte media are beginning to be sold and at less than one-tenth the price.

The unavailability of this equipment for scientific and educational organizations is checking the conducting of the necessary research, especially at the final stages, and is lending the instruction of specialists a bookish nature. For example, in China the complete chain—from the designing of large integrated circuits to their production—exists are two or three educational institutions. For the present we do not have such chains at a single higher educational institution.

Today this problem has assumed enormous importance. For the meeting of the needs the production volume of equipment, according to our estimate, should be increased in 1995 by fivefold, research and educational centers should be equipped, and the subsectors of electronic machine building and electronic chemistry should be established. The corresponding decisions are being prepared.

These problems should be properly reflected in the Comprehensive Program of Scientific and Technical Progress.

In his speeches M.S. Gorbachev has repeatedly stressed the particular importance of the social sciences and their role in the substantiation of the most effective means of restructuring Soviet society and has noted the need to overcome in a short time the serious lag of the social sciences and to develop Marxist-Leninist theory creatively as applied to the new tasks. This especially concerns economic science.

Its best representatives, starting in the 1960's, spoke in favor of radical changes in the system of management and administration and in favor of the changeover to economic methods and foresaw the negative consequences, to which the administrative system of management leads. In particular, Academician V.S. Nemchinov, who during those years headed the Economics Department, spoke out from such a position. Recently the journal KOMMUNIST published his 25-year-old article, which today also sounds topical, inasmuch as it substantiates the necessity of the restructuring of planning, the changeover of enterprises to full cost accounting, and the transition to management through economic interests with the extensive use of economic methods.

At the same time in economic science the conservative element was very strong, commentary predominated, and a number of scientific institutions and first of all the main institute—the Institute of Economics of the USSR Academy of Sciences—lost touch with life. Now economic science is being restructured, but this is just the start. Very much still has to be done in order to restore the lost positions, to strengthen the contact with life, and to join actively in the elaboration of theoretical and applied problems, in the acceleration of socioeconomic development, in the restructuring of the economy, and in the reform of management.

One of the main tasks of economists is scientific analyses of the 13th Five-Year Plan and the long-range future. Here the Institute of the Economics and Forecasting of Scientific and Technical Progress, which was organized by Academician A.I. Anchishkin, who recently died prematurely, is playing a dominant role. This institute under the supervision of Aleksandr Ivanovich prepared and submitted to the State Planning Committee on the set date detailed suggestions on the conception for the 13th Five-Year Plan. We expect that economists will also make a large contribution to the preparation of the Comprehensive Program of Scientific and Technical Progress—its first generalizing materials should be presented already during the first quarter of next year.

The Central Committee and the Soviet Government are enlisting scientists, including economists, in the work on the reorganization of our society. The scientific section of the governmental commission for management—the basic interdepartmental organ in the country, which is preparing decisions on the restructuring of management—is basing its work at the Economics Department. Executives of the Economics Department have been made members of the governmental commission along with executives of central economic departments. Thereby economic scholars and other social scientists have received an opportunity to be directly included in the government with scientifically sound specific proposals on the restructuring of management, and, hence, their responsibility for the correctness of scientific substantiations and recommendations has increased. They have joined in the common cause of carrying out the radical reform of management.

But it must be frankly admitted that we do not yet have a developed theory of the economic mechanism, which would be equal to the present stage of socialist development, the scientific and technical revolution, and social progress. Therefore, the important task of elaborating the theoretical problems of the economic mechanism faces political economists, first of all the Institute of Economics of the USSR Academy of Sciences and its management. If the question is stated more broadly, it is a matter even not of an economic mechanism, but of a social mechanism and of the stimuli of the self-development of our economic system—as Academician T.I. Zaslavskaya poses the question. And we at the academy need to organize the cooperation of sociologists and economists and to conduct an extensive series of studies on the problems of the social mechanism, which will help to put to use the enormous untapped reserves and advantages of our socialist system.

Direct assignments meant for the Academy of Sciences are contained in the Statute on the Restructuring of the Work of Central Economic Organs, which was adopted by the CPSU Central Committee and the USSR Council of Ministers. In particular, the decision on the organization of the Institute of Socioeconomic Problems of Settlement with its subordination to the USSR Academy of Sciences and the State Committee for Labor and Social Problems was adopted. A joint scientific council of the State Committee for Labor and Social Problems for problems of labor and social development should be established. The USSR Academy of Sciences is being enlisted in the elaboration of a number of problems of planning and social norms of scientific and technical progress. We should complete these assignments in the indicated time and at a high scientific level.

It is necessary to speak separately about the tasks of Soviet sociological science. The work of the Institute of Sociological Research is being justly criticized. For the present it does not satisfy the increased demands on this science. The work of the Soviet Sociological Association headed by Academician T.I. Zaslavskaya, the new chairman, is being reorganized. The USSR Academy of Sciences has submitted to the Central Committee major proposals on the strengthening of sociological science and sociological education in the country in order to involve sociology scholars more actively in the common cause of restructuring.

I would also like to speak about the increasing responsibility of juridical science. Its role is exceptionally great, inasmuch as in conformity with the decisions of the June CPSU Central Committee Plenum new economic legislation is being developed, old acts are being repealed, and our Institute of State and Law headed by Academician V.N. Kudryavtsev is taking a most active part in all this work.

The responsibility of social scientists in the promotion of the decisions of the June CPSU Central Committee Plenum is also great. In the country economic universal education has been announced, political and economic training is being organized. The personnel of the USSR Academy of Sciences and our journals should actively participate in this work, which is being headed by the CPSU Central Committee. Specific steps are being taken in this direction. The Economics Department, for example, has joined in the advanced training of management personnel at the USSR Academy of the National Economy, has prepared suggestions on the combining of efforts with the Economics Faculty of Moscow State University, and together with the USSR Ministry of Higher and Secondary Specialized Education is dealing in earnest with the improvement of the training of economic personnel. It is necessary not to relax the attention to this important section of the work.

A few words about our international relations. Here we are sensing most strongly the effect of the mechanism of deceleration. There is an external mechanism of deceleration, a quite understandable mechanism, for example, the Reagan Administration has posed the task to isolate Soviet science and is accomplishing it with a large scale, with the allocation of money, with the corresponding acts, and so on. But there is also our internal mechanism of deceleration. We ourselves often do not display the necessary activity. There is, for example, the Humboldt international stipend. Our Academy of Sciences back during the last century joined the corresponding society, which organized these stipends. We have the opportunity to send to major centers of the FRG a large number of young scientists. But we are sending at most five people—our institutes are not selecting more. Perhaps they are not interested?

A conference on artificial intelligence was recently held. In all 3,500 scientists of the entire world attended it. An enormous exhibition, practically without any embargoes, at which work stations and commercial programs of artificial intelligence were displayed, was organized. But there were only four delegates and not one young scientist from our country.

If you travel to American universities and large scientific centers, you will see there a minimum of 50 Chinese students (in all there are 30,000 of them there), Japanese, Europeans, representatives of developing countries—and not one young Soviet scientist! The presence at these centers of our young scientists and the use of the opportunities, which are afforded here for the training of scientists, should be the result of the activity of both our Foreign Relations Administration and the chief scientific secretary. Many difficulties will have to be surmounted, but we ourselves must understand that there are also some centers, at which the entire world is studying. The point is not that we are learning from someone and are admitting our lag. We also have such unique centers, and we ourselves are using them inadequately even for "internal" instruction. They also exist abroad. We can now broaden such contacts, especially considering that the interest of the world community in the Soviet Union and in contacts with it is increasing despite the actions of the American administration. Taking into account the contacts, which the older generation has with the world scientific community, we can work more vigorously on this task.

Another urgent question is the question of information supply. We have raised it many times, but both in the country as a whole and at the academy information supply has been poorly organized. This is one of the most urgent questions, which it is necessary to raise and settle on the same level as the question of scientific instruments. Advanced means of communication give scientists and engineers direct access to information without an mediation of various information institutions. We have even solved one problem. Four schools in Moscow and one in Pereslavl-Zalesskiy can now converse in real time via electronic mail. The children are conversing, but we have not learn to. And there are difficulties and obstacles here, but we need to solve this problem.

Finally, Academician G.I. Marchuk spoke about such an important task as the scientific support of the process of international detente and disarmament. It is well known what immense work the CPSU Central Committee and the government are performing, what attention has been attracted throughout the world to the Soviet Union, and how greatly the character of the Soviet Union has changed in the eyes of the public and simple people of the entire world as a result of this immense work. But this work should have real practical and scientific support, because this question is difficult, at times they specially confuse it. Take if only the strategic defense initiative. This is a problem that requires scientific clarification, it is difficult not only for the "philistine," but also for any layman. We have worked on this. The Committee of Soviet Scientists in Defense of the World Against the Nuclear Threat wrote, relying on academic institutes, first of the Institute of Space Research, the Computer Center, the Institute of the United States of America and Canada, and others, two works on "nuclear winter" and on space weapons. They found a great response in the world. This work must be developed.

Here we do not always act in the best manner. At one time the Academy of Sciences proposed to establish a network of seismic stations for the transmission of signals on test explosions, but was not able to do this. Now we have corrected the situation somewhat by the fact that we conducted jointly with the U.S. Commission for the Production of Natural Resources an experiment, the goal of which is to check whether it is possible to detect and evaluate explosions with a power of 1 kiloton. A 10-ton test explosion was conducted, and the signal exceeded the level of noise by a hundredfold. This result is also of purely scientific significance.

But the task to attain already next year the level of information transmission from the entire country and from the entire network on a real time scale faces us. We are now fulfilling it. But this is also only the start, because to ensure the process of disarmament means to set up verification at the launch pads and verification in space and in general to settle all questions of verification as a whole.

The revolutionary changes in society, which our people are now experiencing, are unquestionably supported by the academy, and we will apply all efforts and means with allowance made for our traditions and our potential to accomplish the great tasks arising here.

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Presidents of Academies of Sciences of Socialist Countries Meet

18140147a Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 12, Dec 87 pp 79-80

[Article by P.S. Orayevskiy under the rubric "International Scientific Relations. Brief Reports": "On the Conference of Presidents of the Academies of Sciences of the Socialist Countries"]

[Text] The 4th (Extraordinary) Conference of Presidents of the Academies of Sciences of the Socialist Countries was held on 3-5 June 1987 in Budapest at the invitation of the Hungarian Academy of Sciences.

Delegations of the Bulgarian Academy of Sciences headed by President of the Bulgarian Academy of Sciences Academician A. Balevski, the Hungarian Academy of Sciences headed by President of the Hungarian Academy of Sciences Academician I. Berend, the SRV National Center of Scientific Research and the SRV Committee of Social Sciences headed by President of the National Center of Scientific Research Nguyen Van Hieu, the GDR Academy of Sciences headed by Vice President of the GDR Academy of Sciences Professor U. Hofmann, the Cuban Academy of Sciences headed by Vice President of the Cuban Academy of Sciences Doctor Noel Toledo, the Mongolian Academy of Sciences

headed by President of the Mongolian Academy of Sciences C. Tseren, the Polish Academy of Sciences headed by President of the Polish Academy of Sciences Academician J. Kostrzewski, the Romanian Academy and the Romanian Academy of Social and Political Sciences headed by President of the Romanian Academy Academician R. Voinea, and the Czechoslovak Academy of Sciences headed by President of the Czechoslovak Academy of Sciences Academician J. Riman participated in the conference.

The USSR Academy of Sciences was represented at the conference by: President of the USSR Academy of Sciences Academician G.I. Marchuk, Vice President of the USSR Academy of Sciences Academician K.V. Frolov, and Chief Scientific Secretary of the Presidium of the USSR Academy of Sciences Academician G.K. Skryabin.

Taking into account the urgent need for the direct sharing of the experience of the work and organizational activity of the academies of sciences in light of the decisions of the 27th CPSU Congress and the recent congresses of the fraternal Communist and Workers' Parties of the socialist countries, particularly on the problems, which are connected with the restructuring, which is being carried out in our country, as well as the implementation of the Comprehensive Program of Scientific and Technical Progress of the CEMA Member Countries to 2000, the following questions were considered at the conference: the structure and activity of the academies of sciences and their role in the scientific and technical progress of the socialist countries; the participation of the academies of sciences in the implementation of the Comprehensive Program.

At the conference it was noted that the academies of sciences of the socialist countries are playing an important role in the acceleration of scientific and technical progress. In this connection all efforts and material resources should be concentrated first of all on the development of basic research and its combination with the tasks of applied research. It was emphasized that the stable combination of science and production is a firm basis for the use of the results of basic research and new discoveries in technology and for the expansion of the production of items of the highest quality.

The conference participants unanimously agreed that the present international situation is facing the academies of sciences of the socialist countries with a number of important problems, which require common approaches and coordinated solutions. The conference considered it necessary to strengthen the bilateral and multilateral contacts between scientists, to use more completely the already established forms of joint work, and to seek new opportunities and methods for the purpose of achieving more effective cooperation. The importance of the formulation of forecasts for scientific research and technical progress was stressed and the great importance of the further intensification of cooperation with higher educational institutions was noted.

The conference specified that the analysis of the trends of development of world science and the preparation of suggestions on the further development of the Comprehensive Program of Scientific and Technical Progress of the CEMA Member Countries by means of conferences of representatives of the academies of sciences of the socialist countries with the subsequent implementation of these suggestions through CEMA or through the national state committees for science and technology are the main task of the multilateral cooperation of the academies of sciences of the socialist countries.

The conference of presidents deemed it expedient to unite the efforts of the academies of sciences of the socialist countries for the purpose of the joint elaboration of new major projects to 2000 on the following problems: ecology, high-temperature superconductivity, man and the environment (bioscreening).

During the examination of the question of the participation of the academies of sciences in the implementation of the Comprehensive Program of Scientific and Technical Progress the conference noted that each of the academies had already made a definite contribution to the fulfillment of this program, which is the basic of practical actions, which lead to the acceleration of scientific and technical progress, and one of the basic forms of the diverse cooperation between the socialist countries. The basic tasks of the academies of sciences of the socialist countries on participation in the Comprehensive Program of Scientific and Technical Progress of the CEMA Member Countries were specified, here it was stressed that the basic research, which is being conducted by the academies of sciences, is the basis of the successful accomplishment of the tasks that have been posed in the priority directions of the Comprehensive Program.

The advisability of establishing coordinating councils of the academies of sciences of the socialist countries for the problems of new materials and biotechnology, which together with the already existing and actively working coordinating councils for scientific instrument making and automation, as well as for information science and computer technology will become a unified mechanism of the participation of the academies of sciences of the socialist countries in the fulfillment of the priority directions of the Comprehensive Program, was indicated.

In the communique, which was adopted in accordance with the results of the work of the conference, it is stressed that the academies of sciences of the socialist countries regard as extremely important solidarity and the expression of unity not only in the area of scientific cooperation and scientific and technical progress, but also in the struggle for the elimination of the nuclear threat and for peace and security throughout the world. Science should serve the increase of the well-being of peoples. This lofty goal is decisive in the activity of scientists, who are struggling for its achievement by means of science.

The heads of the delegations, who are presidents of the academies of sciences of the socialist countries, were received by General Secretary of the Central Committee of the Hungarian Socialist Workers Party J. Kadar.

The work of the conference proceeded in a businesslike friendly atmosphere with the complete mutual understanding of its participants.

The members of the delegation of the USSR Academy of Sciences had numerous meetings and conversations with executives of the Hungarian Academy of Sciences and prominent Hungarian scientists. A meeting with Hungarian Minister of Industry L. Kapolyi was held. The useful exchange of opinions on the state and prospects of the further development of Soviet-Hungarian scientific and technical cooperation took place.

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USSR-GDR Cooperation in Automation

18140134 Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV in Russian No 9, Sep 87 pp 51-55

[Article by Gerhard Proft, deputy director of the Scientific Research Institute of the State Planning Commission attached to the GDR Council of Ministers: "GDR-USSR: The Modernization and Automation of Key Sectors"; first paragraph is *Ekonomicheskoye Sotrudnichestvo Stran-Chlenov SEV* introduction]

[Text] In the drafting of plans and their efficient implementation the GDR is relying on firm understandings on the further intensification of socialist economic integration. Here the fraternal cooperation with the Soviet Union, which is dictated more and more by the needs of intensification, holds a special place. The increasing demands on the scientific and technical level and quality of items and on the strict fulfillment of contract obligations are connected with this.

In the Report of the Central Committee of the Socialist Unity Party of Germany [SED] to the 11th SED Congress General Secretary of the SED Central Committee and Chairman of the GDR Council of State Comrade E. Honecker stressed: "Reciprocal barter in the amount of more than 380 billion marks has been agreed upon for the current five-year plan, which attests to the scale of our cooperation. The world does not know more long-term agreements, which would be characterized if only approximately by such a gigantic figure. The dynamics of reciprocal deliveries is governed to an increasing extent by the development of scientific research and production cooperation, which has encompassed nearly all sectors. The development and efficient use of the latest key technologies, the output of new products, which correspond to the world technical level, and cooperation in the area of the production of foodstuffs and industrial consumer goods are acquiring vital importance. The potential of machine building and other sectors of the processing industry of the GDR will be oriented to a greater and greater degree toward the meeting of the needs of the USSR and the other socialist countries."

1986-1990: The Increased Level of Cooperation

As is known, during 1981-1985, when the development of the national economy of the republic was determined to a decisive extent by intensification, it was possible to achieve constant growth in the economy and the further increase of labor productivity.

The SED directed attention in good time to the present, moreover, the world level of scientific and technical development. The economic strategy of the party to 2000 is aimed at the more efficient combination of the achievements of the scientific and technical revolution, which has entered a new stage, with the advantages of socialism. Microelectronics, advanced computer hardware, as well as computer-aided engineering, designing, and production management now determine to a greater and greater degree the national economic potential. Key technologies are being introduced—flexible automated production systems, new processing technologies and new materials, biotechnology, atomic energy, and laser technology.

Such development, on the one hand, requires great efforts and, on the other, also provides a chance for the rapid updating of production, the improvement of quality, and the decrease of expenditures on an unprecedented scale. The increase of labor productivity, in practice a new potential, on which how our economy will be able to ensure the further progress of the country, to meet the needs of the population, and to consolidate positions on the world market depends, is possible precisely on this basis.

The Law on the Five-Year Plan of Development of the GDR National Economy for 1986-1990 envisages in conformity with the Long-Term Program of the Development of Cooperation Between the GDR and the USSR in Science, Technology, and Production for the Period to 2000 the intensification of their economic, scientific, and technical interaction. Here cooperation concerns fundamentally new processes in science, technology, and production. The close contacts of our states in the development and use of advanced key technologies are at the same time also an effective contribution to the implementation of the Comprehensive Program of Scientific and Technical Progress of the CEMA Member Countries to 2000 (KP NTP).

The ever increasing extension of long-term cooperation with the Soviet Union on the basis of a bilateral program is basic for the further stable social and economic development of the GDR and the acceleration of intensification and is making it possible to achieve the great

efficiency of the national economy. The intensification of specialization and cooperation in science, technology, and production serves as a condition of this. On the basis of the requirements of the scientific and technical revolution it is necessary to place in the forefront in cooperation the development and production of new items, machines, equipment, and systems of instruments with a high degree of science intensiveness. The direct scientific, technical, and production relations of combines, enterprises, and organizations should make a contribution to the successful accomplishment of the agreed on tasks.

At present basic attention is being devoted to the cooperation of both countries in machine building, electrical engineering, and electronics, especially in machine tool building, microelectronics, and computer technology, which are playing a basic role in the modern equipment of the national economies, as well as in complete mechanization and automation.

The profound changes of structural and investment policy and the shift of the center of gravity in the direction of qualitative factors of economic growth will lead to the technical modernization of the national economy, which has been planned in the Soviet Union for 1986-1990. The formulated programs envisage the comprehensive updating of the entire machine building complex and the achievement on this basis of leading positions in such fields as computer technology, production automation, robotics, biotechnology, and new materials. In the USSR it is planned by 1990 to put into operation about 2,000 robotized complexes, the same number of flexible machine systems, and tens of thousands of modern machining centers and technologies.

With allowance made for the needs of the renovation and modernization of production of the Soviet Union the GDR, being its main partner, is systematically orienting its long-range economic, scientific, and technical cooperation, in turn, the Soviet Union is taking into account in its plans the national economic needs of the GDR.

The task up to 1990 is to increase the barter in those items, which play an important role in the assimilation of advanced key technologies. First of all microelectronic components, as well as special equipment for their production, high-performance NC machine tools, flexible production sections, machining centers, robots, computers, and information hardware belong here. In microelectronics alone the reciprocal deliveries during this period will increase by more than threefold. The new assortment of items is determining to a greater and greater degree the export program of the GDR to the USSR. It includes, for example, flexible production systems, automated production sections, robots, natural gas filling stations for motor vehicles, advanced rolling equipment, and high-performance machines and equipment for the agroindustrial complex and light industry.

Thus, the products of machine building, including electrical engineering and electronics, which account for about 70 percent of the exports of the GDR to the USSR, during 1986-1990 will also remain the basic export item of our republic.

The understandings with the Soviet Union are advancing great demands before the combines of all sectors, and first of all these three named sectors. Items, which correspond to the world level, and a flexible reaction to the needs of the client are expected of them, in order thereby to become worthy partners of Soviet enterprises and organizations.

The mutual support of the GDR and the USSR in case of the renovation and modernization of production capacities is not limited to the exchange of complete plants and individual types of equipment within the framework of traditional foreign trade relations. Another developing form of cooperation, which is connected with reciprocal deliveries of equipment and technology, as well as nonmaterial services, is the joint renovation and modernization of industrial enterprises of both countries. Here valuable experience has already been gained and significant achievements exist. Thus, the joint modernization and renovation of electric motor plants in the cities of Yaroslavl and Wernigerode, 15 plants in the cities of Penza and Magdeburg, as well as furniture factories in the cities of Ulyanovsk and Eilenburg have been successfully completed. At present the GDR is aiding in the modernization of 19 plants of light industry of the USSR. Here it is a question not only of deliveries of machines and equipment and the transfer of new technologies. Joint designing with allowance made for the available equipment and machines is acquiring greater and greater importance. The development of new designs and technologies, which increase production efficiency and product quality, is especially important.

Such a type of the joint activity of enterprises begins, as a rule, with cooperation in scientific research and technical development—one of the types of direct ties. It is carried out on the basis of contractual understandings on joint or concerted measures on the development of new items and the devising or improvement of technological principles, technologies, and the organization of production.

Joint modernization and renovation as a part of systematic GDR-USSR economic cooperation are undergoing development, and new assignments are specified when coordinating the five-year plans. The mutual obligations (material, financial, and others), which follow from these assignments, are becoming a component of the protocol on the coordination of plans, as well as the long-term trade agreement, which is concluded on its basis.

Qualitatively New Stimuli of Interaction

The qualitative change in GDR-USSR cooperation in machine building, electrical engineering, and electronics is connected to an ever increasing extent with the

changeover of both countries to the flexible automation of production. This also conforms to the tasks, which were agreed upon by the CEMA member countries in the Comprehensive Program of Scientific and Technical Progress of the CEMA Member Countries to 2000, that is, the achievement by combined efforts of leading positions in the areas, which determine the pace and level of development in science, technology, and production on the approaches to the next century. The most important task in this direction is all-round integrated automation.

Specific measures of cooperation in this area are envisaged by the intergovernmental agreement on automation and mechanization in machine building. Both in the GDR and in the Soviet Union the automation of production is raising a number of new and difficult problems. The experience of the GDR and the successes in the increase of efficiency and the study of the emerged revolutionary changes in technology, especially in metal working, convince us of the need for the extensive introduction in the next few years of flexible machine systems. The acceleration of comprehensive intensification objectively requires the significant shortening of the time of the introduction of both individual components of automation and sets of automated works.

In the Directives of the 11th SED Congress the solution of vital problems, the increase of labor productivity at selected facilities by 500-600 percent and the utilization of equipment to 17-20 hours a day, the decrease of the production cost by 15-20 percent, and the saving of 20-40 percent of the materials are linked with automation. Thus, a new level of the efficient use of the latest achievements of science and technology has been outlined.

In the Soviet Union analogous goals are being set: for example, the use of new equipment not less than 20 hours a day is envisaged, which will make it possible to increase the annual available machine time by ninefold as compared with ordinary machine tools which operate one shift; to reduce the staff of workers by one-third to two-third, the time for the preparation of production by 50-75 percent, and the machining of items by 90-96 percent, as well as to decrease the production cost of items by 10-20 percent. The loading factor of basic equipment should be increased to 0.85-0.9, while the shift coefficient should be increased to 2.6-3.

The impact, which should be derived by means of automation in the national economy, and the tasks of the technical renovation of production explain the great interest of the Soviet Union in importing highly efficient automation equipment, here particular attention is being devoted to comprehensive solutions of problems from the designing to the introduction of systems in production.

The task of organizing further scientific, technical, and production cooperation with allowance made for the new requirements of the times faces the GDR economy, which is closely linked with the USSR national economy. In recent years significant changes have occurred in the program of the export of metal working products to the Soviet Union. Thus, machine tool building is delivering first of all highly productive specialized machine tools, semi-automatic and automatic machine tools, as well as automatic lines. The export of standard equipment decreased from 75 percent in 1975 to 30 percent in 1985, while the export of automated equipment, including with numerical control, increased from 20 to 50 percent. Automatic lines and systems make up 20 percent of the exports.

These deliveries provided Soviet enterprises with equipment, which is making it possible to achieve a large increase of productivity. It is envisaged to deliver by 1990 to the Soviet Union 9 flexible production systems and 150 flexible production sections for the machining of prismatic and rotary-symmetrical parts. The export of this equipment is evidence of the orientation of GDR machine tool building toward the meeting of the needs of its basic partner—the Soviet Union. Soviet orders are contributing to the formulation of comprehensive technological solutions in the form of modular systems. Their share in the output of GDR machine tool building by 1990 will be equal to 40-50 percent.

As to the stepping up of cooperation in science, engineering, and the development of advanced technology, it is necessary to cooperate even more closely at all stages from development to production and thereby to gain time, to use the production and economic impact as much as possible, and to ensure the great competitive ability of items. All of this is contributing to the development of effective national economic structures, which complement each other, the achievement of a high technical and economic level of production, the development and use of efficient technologies and means of production (for example, microelectronics, robots, and automation equipment), and the better meeting of the needs for high-quality consumer goods.

At the 3d SED Central Committee Plenum (November 1986) it was stressed once again that the intensification of socialist economic integration is a solid foundation of the fulfillment of all the plans of the GDR and that the SED subsequently will also support and advance this cooperation to the utmost. Comrade E. Honecker stressed in the closing speech at this plenum that the scale, which has been achieved in cooperation, and the close interconnection of many sectors of the national economies of the GDR and the USSR do not have analogs in the world. It was noted that the programs and agreements between both countries are based to a greater and greater degree on the requirements of the achievement of the highest scientific and technical level and the intensification of production.

Comrade E. Honecker named the new understandings on economic, scientific, and technical cooperation, which were reached during the meetings with Comrade M.S. Gorbachev during the period of the 11th SED Congress and in Moscow, as an excellent base for the further development of the qualitatively new stage of relations between both countries. The following steps are envisaged:

—the intensification of cooperation in such important areas as the development of base technologies for high-integration circuits and specialized technological equipment and materials for microelectronics, moreover, the accomplishment of jointly posed tasks of microelectronics, which are contributing to the development and production of specialized technological equipment and technologies for high-integration storages (1-4 megabytes), is of the greatest importance;

—the development and introduction of electronic computer hardware, as well as plant management automation systems/computer-aided design systems;

—the use of highly efficient technologies in metal working, including laser equipment;

—the production of new materials, especially in the area of technical ceramics, as well as high-quality metallurgical items and products of polymer chemistry;

—the extensive introduction of biotechnology in agriculture and the microbiological industry;

—the development of advanced digital communications equipment and light guide systems;

—the increase of the skills of management personnel in the sphere of economics and science at special centers, as well as at combines and associations;

—the further development of direct ties between combines, enterprises, and organizations of the GDR and associations, plants, and organizations of the USSR and the establishment of joint collectives of specialists in conformity with recently signed agreements.

Practically all combines of the GDR are maintaining long-standing relations with partner organizations from the USSR. A broad base for the development of direct ties already exists, and the signed agreements strengthen the basis of their more efficient use.

The understandings encompass in fact all the significant fields of science and technology and are aimed at the qualitative intensification of cooperation in individual sectors of the national economy. This is creating important prerequisites for the rapid solution of urgent economic, scientific, and technical problems of both countries and serves the strengthening of the economic and defense potential of the socialist community as a whole.

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Goals, Results of CEMA Cooperation in Machine Building

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[Article by Deputy Chairman of the USSR State Planning Committee G. Stroganov, chairman of the Bureau of the CEMA Committee for Cooperation in Machine Building, under the rubric "The Priority Tasks of Restructuring": "The Development of Cooperation of the CEMA Member Countries in the Acceleration of Scientific and Technical Progress"]

[Text] Machine building is playing a leading role in the qualitative transformation of the production and technical base of all sectors of the national economy on the basis of the latest achievements of science and technology. The means of production, which are being produced, are having a profound effect on scientific and technical progress and determine the technical level and accordingly the level of labor productivity. Therefore, the problem of seeking new forms of cooperation of the CEMA member countries in machine building is acquiring at present particular urgency and significance.[1]

The production of machine building products in the USSR during 1981-1985 increased by 36 percent, advanced technologies, automation equipment, microprocessor equipment and industrial robots, and NC metal-cutting machine tools were introduced, which in many respects predetermined the high growth rate of labor productivity in the sector. Cooperation with the socialist countries, which is being carried out both within CEMA and on a bilateral basis, and the specialization and division of production programs contributed to a significant degree to the development of machine building. Moreover, the specialization and cooperation of production increased more rapidly than the reciprocal commodity turnover of machines and equipment. The proportion of exports of specialized and cooperated products in the total volume of reciprocal exports of machine building products of the CEMA member countries in 1986 exceeded 42.5 percent.

Scientific and technical relations last year alone made it possible to develop more than 210 new machine building items. Among them are industrial robots for the attendance of metal-cutting machine tools, forging and pressing equipment, machines for pressure die casting and painting operations, new types of rotary combines for the harvesting of cereals, four- and six-row machines for the planting of potatoes, and production lines for the centralized cutting of boards in the wood processing industry. Prototypes of diesel engines for trucks and passenger cars were produced.

Multilateral cooperation in machine building is being carried out at present on the basis of more than 100 agreements on the specialization and cooperation of production and more than 80 agreements in the scientific and technical area. Within them the specialization of countries in the production of approximately 20,000 types and type sizes of machine building products is established. The largest reciprocal specialized deliveries are being carried out in shipbuilding, agricultural machine building, the automotive industry, and a number of other sectors.

At the same time during the past 5-year period in the European states of the socialist community (with the exception of Bulgaria and Hungary) the average annual growth rate of the output of machine building decreased and came in Bulgaria to 9.8 percent, Hungary—3.4 percent, the GDR—6.1 percent, Poland—1.3 percent, Romania—5.5 percent, the USSR—6.2 percent, and the CSSR—4.8 percent. Negative processes appeared: the updating of products slowed, the technical level and quality lagged behind the world level, the level of cooperation in production between the CEMA member countries was low (in the total volume of specialized deliveries of machines and equipment assemblies and parts account for only 10-15 percent), the technological lag behind developed capitalist states remained with respect to a number of most important groups of machine building products.

Under these conditions the party and state leadership of the socialist countries took a number of steps. At the Economic Summit Conference of CEMA Member Countries (Moscow, 1985) a common strategy was formulated—to achieve the resolute acceleration of the socioeconomic development of the countries by a sharp turn toward the intensification of social production by means of profound changes of the proportions in machine building and the implementation of a set of measures on the increase of the technical level of products and the quickest introduction in production of the latest achievements of science and technology.

This line found reflection in the economic policy of all the fraternal parties. Thus, the strategic policy of the acceleration of the socioeconomic development of the country on the basis of the combination of the achievements of the scientific and technical revolution with a planned economy, the efficient use of the new economic mechanism, the changeover to economic methods of management, and the development of democracy was adopted at the 27th CPSU Congress. It received further specification at the June (1987) CPSU Central Committee Plenum. The need "to study carefully and thoroughly the experience of friends and to adopt everything that can be used in the interests of the USSR national economy"[2] was also noted at the plenum.

All this requires the achievement of the rapid changeover to the new intensive type of the international socialist division of labor, which would be based on the more active interaction of the scientific and technical and the production potentials of the CEMA member countries. The role of cooperation in the area of machine building—the physical vehicle of the results of the scientific and technical revolution—is also increasing accordingly.

Machine Building Is the Heart of Intensification

Great and difficult tasks on the assurance of the intensive development of both the national economy as a whole and machine building production itself have been set for machine builders. That is why significant attention is being devoted not only to the meeting of the needs for modern machines and equipment of a high technical level and quality, but also to the improvement of the qualitative structure of the machine building complex itself: to the leading development of the base sectors—machine tool building, instrument making, and the production of electrical engineering products, as well as to retooling and modernization and to the introduction of advanced technologies and modern forms of the organization of production.

In the USSR these directions found reflection in the state plan for 1986-1990. Thus, an increase of the output of products of the complex by 43 percent with a growth of the production volume of industry by 25 percent is envisaged. A significant portion of the increase of machine building output will be achieved by the saving of material and technical resources and the increase of the production of those types of it, which determine the technical level of all social production—means of automation and mechanization, electronic computer hardware, and instrument making. Much attention is being devoted to the increase of the production of qualitatively new consumer goods.

A substantial increase (from two- to tenfold) of the production of machining centers, NC machine tools, robots and robotic complexes for flexible production modules and systems, rotary and rotary conveyor lines, computer-aided design systems, and microprocessors is planned. By 1990 from 80 to 95 percent of the basic types of machine building products should conform to the world level. Their annual updating will come to 13 percent. The replacement of fixed production capital will increase to 10 percent.

These tasks are backed by significant material resources. In all 1.8-fold more capital investments have been allocated to machine building than during the preceding five-year plan, moreover, 2.4-fold more to machine tool building, 3.5-fold more to instrument making, and 2-fold more to electrical engineering. More than 50 percent of the productive capital investments are being channeled into retooling and modernization.

The June (1987) CPSU Central Committee Plenum thoroughly analyzed the development of the national economy and the state of affairs in the economy of the country and specified the priority tasks of the present

stage of radical restructuring. The radical reform of economic management, which is based on the USSR Law on the State Enterprise (Association), has been brought today to the forefront. Much has to be done, a program of actions was clearly specified at the Central Committee Plenum and the 7th Session of the USSR Supreme Soviet. Now the main thing is the development of an integrated, effective, flexible system of the management of the economy.

It should be noted that as of January 1988 all enterprises and associations of the sectors of the machine building complex will operate under the conditions of full cost accounting and self-financing. Under these conditions the role and functions of ministries in the management of the sectors of the national economy are changing substantially. They are obliged on the basis of the preferential use of economic methods of management to implement consistently the principles of management, which are specified by the USSR Law on the State Enterprise (Association). The role and responsibility of ministries, the scientific, technical, and economic headquarters of sectors, for the satisfaction of the national economy with the output, which is produced by the sector, and for the attainment of the world level of production technology and the quality and technical level of products will increase.

For the purposes of the further increase of the level of concentration of production and the improvement of management along with production and scientific production associations new forms of large organizational structures—state production associations, which are established as unified production economic complexes and are managed on a democratic basis by the council of directors headed by the general director, will be formed in the sectors of machine building and in regions. In short, the large-scale restructuring of the activity of the centralized management of the national economy lies ahead. Together with the changeover of enterprises to full cost accounting, self-financing, and self-support [samookupayemost] this work constitutes a unified whole—the radical reform of the management of the economy, including foreign economic relations.

"The restructuring of economic management," it was noted at the CPSU Central Committee Plenum, "is affording extensive freedom for the increase of the efficiency of our foreign economic relations and—what is especially important—for the increase of the influence on the part of foreign trade on the work of sectors and enterprises, on the quality of their products, and on scientific and technical progress.

"In this connection the increase of the effectiveness of cooperation with socialist countries is of fundamental importance. The restructuring of the economic mechanism is called upon to create favorable economic and organizational legal conditions for the extensive integration of our national economy with the national economy of the fraternal countries."[3]

The rapid development of the latest science-intensive works is envisaged by practically all the European socialist states. This is due first of all to the extension and improvement of cooperation, the development of its new forms, the broadening of direct scientific production contacts, the establishment of joint enterprises and collectives, the combining of efforts on the implementation of the Comprehensive Program of Scientific and Technical Progress of the CEMA Member Countries to 2000 (KP NTP SEV), the tightening up of contractual discipline, and the increase of the responsibility of the parties for the high-quality fulfillment of the assumed obligations.

Thus, in Bulgaria with an increase of industrial output during the current five-year plan by 25-30 percent the production of machines and equipment will increase by 50 percent, including electronic computer hardware by twofold, microcomputers by more than 2.5-fold, and industrial robots by threefold. In the GDR the basic emphasis has been placed on the development and assimilation in production of flexible automated production systems, modular microelectronic control systems, instrumentation, and flexible automated transportation, warehousing, loading, and unloading complexes. During 1986-1990 it is planned to produce 75,000-80,000 industrial robots. In Romania the increase of the output of products of machine building by 63 percent with a growth of the commodity production of all industry by 43.3-49 percent is envisaged. In the CSSR the output of machine building products will increase by 30 percent, here the production of equipment for atomic power engineering, energy- and resource-saving equipment, robots, and electronic items will be developed rapidly.

The Improvement of the Structure

The intensive means of development with allowance made for cooperation within CEMA requires the creation of mutually complementary sectorial structures, the elimination of unjustified parallelism, and the collective solution of key national economic problems. The present concept of the formation of an efficient structure of the machine building complexes of the CEMA member countries envisages the coordinated development of individual sectors and types of works on the basis of the joint solution of the problems of technical progress and the improvement of the products list with the increase of the proportion of the production of its advanced part.

It is necessary to single out as a special direction of scientific and technical progress in machine building the complete automation of production, which is based on the extensive use of high-performance precision equipment, while in the control of technological processes and works as a whole—microprocessor equipment and computers. The development of modern means of automation involves the assimilation of the production of many types of machine tools, rotary and rotary conveyor lines, systems of program control and computer-aided design

systems, industrial robots, highly mechanized, computer-controlled warehouses, special hydraulic and pneumatic aids, high-performance tools and tool supply systems, and others. A goal program of cooperation (as a component of the Comprehensive Program of Scientific and Technical Progress of the CEMA Member Countries to 2000) was formulated for the accomplishment of this large-scale task.

The joint development, testing, and assimilation in production of a wide range of automation equipment and sets and individual types of machines and equipment are being carried out in conformity with a number of general agreements on multilateral cooperation on the development and organization of specialized and cooperated production and a significant number of multilateral and bilateral economic agreements and contracts. Here for machine building itself the development and assimilation in production on the basis of specialization and cooperation of 25 types of industrial robots and 22 types of robotic systems for the mechanization and automation of labor-consuming and monotonous jobs, 26 types of flexible production modules for various technologies, a number of automated transportation and warehousing systems, 20 types of high-performance automated metal working equipment, as well as automated modules for forging and pressing, robotic and flexible production systems for the automation of assembly operations, means of the tool supply of production, and others are envisaged within the framework of cooperation.

For the achievement of the indicated goals practically all the interconnected sectors of the machine building complex of the fraternal countries have entered into direct cooperation. The scientific and technical cooperation, which is being carried out by them, predetermines the cooperation in the production sphere, which under the new conditions includes both after-sale service and joint appearance on the markets of third countries. Such an approach makes it possible to pursue a coordinated (concerted) science and technology policy and to eliminate parallelism at all stages of the reproduction process.

New Forms of Cooperation

The acceleration of the socioeconomic development of the country is inseparably connected with the further extension of economic, scientific, and technical relations with the socialist countries and with participation in the international division of labor. The consistent implementation of the Comprehensive Program of Scientific and Technical Progress of CEMA, which was adopted at the 41st (Extraordinary) Session of the Council for Mutual Economic Assistance, is the heart of all this work. Its implementation will contribute to the increase of the productivity of national labor in the fraternal countries as a whole by 2000 by at least twofold and to the sharp decrease of the consumption of energy and raw materials per unit of national income.

The CEMA Committee for Cooperation in Machine Building is carrying out the supervision of the organization of cooperation in one of the priority directions of the program—"Integrated Automation," as well as is participating in the implementation of a number of assignments in the priority directions "The Electronization of the National Economy," "New Materials and the Technologies of Their Production and Processing," and "The Rapid Development of Biotechnology."

The front of joint work of machine builders is broad. With respect to "Integrated Automation" alone more than 750 organizations of the CEMA member countries and Yugoslavia (including 168 organizations and enterprises from the USSR) are participating in the accomplishment of 325 assignments that have been included in the detailed programs of cooperation. It is envisaged to develop a significant number of models of new equipment and technology (more than 760 descriptions). About 670 developments will be completed and introduced in production already during the current 5-year period, including more than 100 in 1987 and more than 220 in 1988.

The strengthening of cooperation is based on the active use of new forms of cooperation: the direct production, scientific, and technical relations of joint enterprises and international associations and organizations. Thus, in implementing the program on the development of advanced automation equipment, contracts on direct relations on joint designing and production have been concluded by: the Lvov Konveyer Production Association and the Bulgarian-Hungarian Intransmash Society—automated transportation and warehousing systems; the Astrakhanmashokraska Scientific Production Association (the USSR) and a combine for the protection of metals against corrosion (Bulgaria)—modern systems and robotic complexes; the Gomel Gidroavtomatika Production Association (the USSR) and the Danuvia Plant (Hungary)—automatic hydraulic equipment. A Soviet-Bulgarian scientific production association for the development and production of automatic lines and modules for the machining of parts like "bodies of revolution," of which the Moscow Production Association for the Output of Automatic Lines and Special Machine Tools imeni 50-letiya SSSR and the Pobeda Combine (Bulgaria) are members, has been formed. They have planned during 1987-1990 to design and produce automatic lines for the machining of pistons, cylinder sleeves, and piston rings and 570 automatic technological modules.

This work continues to be actively carried out. A contract on direct relations between the All-Union Scientific Research Institute of Electrical Machine Building (the USSR) and the Research Institute of Electrical Machines (the CSSR) on the development with subsequent cooperation in production of thyratron motors with permanent magnets for NC machine tools and industrial robots was signed. The ENIMS Scientific Production Association (the USSR) and the Scientific Research Center for

Machine Tool Building (the GDR) planned joint work on the development of new generations of flexible production systems and robotic complexes. The designing and joint production of machining centers and flexible production systems and modules will be the subject of the direct cooperation of the Vitebsk Machine Tool Building Plant imeni S.M. Kirov and the Odessa Plant of Precision Machine Tools (the USSR) with the TOS-Olomouc Concern (the CSSR).

It is possible to say that an international production technology complex for the development and production of systems and means of automation is gradually being formed on the basis of the interaction of machine building sectors of the socialist states. Its functioning will enable individual countries of the community to free themselves from the need to develop multisectorial production independently; to concentrate efforts and the production, scientific, and technical potential on the development and production of individual sets and equipment, and to acquire all the necessary equipment within the community.

New forms of direct cooperation are also being actively developed in other sectors of machine building. Since January 1986 the Ternopolskiy kombaynovyy zavod imeni XXV syezda KPSS Production Association (the USSR) and the plant for the production of cultivating machines (the GDR) on the basis of direct ties have been cooperating in the production of beet harvesting machines. The GDR supplies interchangeable diggers, assembled cabs, and elevators, while the USSR supplies the beet harvesting machines themselves. On the basis of a contract on direct cooperation the Pribor Scientific Production Association (the USSR) and the scientific production enterprise for optics and laser technology (Bulgaria) are engaging in the joint development and introduction of means and systems of the on-line checking of the operating conditions of agricultural machinery.

The experience of the development of direct contacts between enterprises, scientific research institutes, and design organizations, as well as of the first joint associations shows that such forms of cooperation make it possible to involve the immediate performers in the integration process and to unite their scientific, technical, and production potential. The opportunity appears to influence to a greater degree the increase of the technical and technological level of production, to improve in a shorter time the technical and economic indicators of a product, and to increase the level of cooperation by means of the prompt settlement of the technical and production questions, which are connected with cooperation, and the mutual consideration of the economic interests of the partners in contract prices. At the same time a number of problems, which are connected with the need to optimize the approach to the choice of the type and directions of cooperation, to extend the mutual study of the scientific, technical, and production possibilities of each other, to formulate jointly comprehensive suggestions on their use, and to tighten up contract discipline in the fulfillment of mutual obligations, also appeared.

The extensive development of direct ties and other advanced forms of direct cooperation and their effectiveness first of all depend on the timely development of the planning principles of cooperation at the state and departmental levels. The new program of the coordination of the national economic plans of the USSR and the CEMA member countries and the multilateral program and bilateral programs of the coordinated development of their machine building sectors should conform to these goals. It is intended to ensure the interconnection of the specific tasks, which are being worked on by economic organizations on the basis of direct ties, with the structural, investment, and technical policy on machine building as a whole and its sectors, which has been coordinated among the countries.

The CEMA Committee for Cooperation in Machine Building approved (Havana, 1987) the draft of "The Long-Range Program of the Development of the Multilateral Specialization and Cooperation of Production With Respect to a Selected Products List to 2000 in the Area of Machine Building." It will be submitted for consideration to the Executive Committee, and then to the session of the CEMA Council. The changeover to a new intensive type of the international socialist division of labor, which requires a more perfect mechanism of the coordination of plans on the basis of the interaction of the scientific and technical potential and production potential of the states of the community, found reflection in the draft.

When drafting this document specialists of the fraternal countries relied on the many years of abundant experience of mutual cooperation, basing themselves on the Comprehensive Program of Scientific and Technical Progress of the CEMA Member Countries to 2000, within which more than 80 contracts, agreements, and protocols on the international specialization and cooperation of production and scientific and technical cooperation in the area of machine building have already been prepared. Detailed programs of cooperation, which envisage the development of equipment and technologies at the world level, have been agreed upon for each problem. They encompass 742 descriptions of machine tools, machines, equipment, and technologies.

The draft of the long-range program specifies the interaction of the CEMA countries on the development and production of 132 types and groups of products in 16 areas of machine building. Its implementation is aimed at the meeting of the needs of the socialist countries for high- performance machines and equipment both for machine building itself and for fuel and raw material sectors, the agroindustrial complex, transportation, the chemical industry, and construction.

The Integrated Automation of Production

One of the most important directions of scientific and technical progress is the integrated automation and mechanization of production, which are called upon to change workplaces radically and to make the labor of workers, kolkhoz farmers, and the intelligentsia more productive, creative, and attractive. This is an important social task.

The present stage of automation is based on the revolution in electronic computer technology, the electronization of the national economy, and the rapid development of robotics, rotary and rotary conveyor lines, and flexible production systems, which ensure high labor productivity. Thus, the development and introduction in the countries of the socialist community of quickly readjustable and flexible production systems for various purposes, as well as completely automated shops and plants will make it possible to increase labor productivity by two- to fivefold and the shift coefficient of equipment by up to 2.8-fold. The time of the performance of work and the expenditures when assimilating the output of new items on flexible systems will be reduced as compared with the usual time and expenditures to five-ninths to two-thirds. The saving of materials, first of all ferrous and nonferrous metals, as well as the reduction of working areas by the arrangement in sets of equipment of a higher technical level will be ensured.

The development and introduction of computer-aided design systems are envisaged for the sharp increase of labor productivity in planning and design operations and the shortening of their time to one-half to two-thirds.

Considerable attention has been devoted to questions of speeding up the work in the area of the development of industrial robots and manipulators, including with elements of adaptation and artificial intelligence. Their use will make it possible to increase labor productivity, as well as to replace people in difficult, monotonous technological operations, which are harmful to the health of man. In the area of robotics the Interrobot International Scientific Production Association has been established and the specialization of the parties (Bulgaria, Hungary, the Republic of Cuba, Poland, the USSR, and the CSSR), which are participating in this association, has been specified. Cooperation on the development of promising standardized designs of industrial robots of the building block modular type for machine building sectors, on the production of components for them, on the performance of work in the sphere of the standardization, unification, and certification of robotic aids, on the training of personnel and the increase of the skills of specialists, and on the organization of the service and repair of industrial robots is envisaged by its program of work for 1986-1990.

The development and introduction of unified means of the automation of loading, unloading, transportation, and warehousing operations will ensure by 1990 the decrease of the proportion of manual labor by not less than 15-20 percent, as well as the freeing of up to 15-20 percent of those who work in these operations. Other measures are also planned, including in the area of the tool supply of metal cutting equipment, components, control devices, and systems of the diagnosis of equipment and devices.

The accomplishment of the tasks of the Comprehensive Program of Scientific and Technical Progress of the CEMA Countries will have a profound effect on all spheres of the life and activity of society, will lead to the cardinal increase of labor productivity in the base sectors of the national economy (first of all in machine building) and the reliability, quality, and competitive ability of the products being produced and to the increase of the output-capital ratio, will sharply reduce manual and unskilled labor, and will increase substantially the general technical level and efficiency of production.

In the Soviet Union much attention is being devoted to the question of the timely and high-quality fulfillment of the assignments of the Comprehensive Program of Scientific and Technical Progress of the CEMA Member Countries to 2000. They are reflected in the state plans; the specific steps, which ministries and departments of the USSR and the main organizations for their realization should implement, have been specified. The understandings, which are set down in the Comprehensive Program and in the decisions of the 41st meeting of the CEMA Session, have been made the basis of the practical activity of ministries and departments on the acceleration of scientific and technical progress and on the carrying out of economic, scientific and technical, and industrial cooperation with other members of the community on the basis of specialization and cooperation.

For the supply of the work with the necessary resources the special sections "The Basic Assignments of the Comprehensive Program of Scientific and Technical Progress of the CEMA Member Countries to 2000" are envisaged in the state five-year and annual plans of USSR economic and social development. The assignments of the plans encompass the entire cycle of work—from scientific research to series production inclusively—and are carried out separately by the following stages:

—scientific research and experimental design work, the development and testing of prototypes;

—the development (construction, modernization) of production capacities, the formulation of standards, the development of technologies, and the production of equipment for the output of the new product;

—the output of the first industrial series.

Thus, assignments on the production of prototypes were included in the 1987 plan: a flexible production module for the cutting of blanks from round and square bars

(with a cross sectional dimension of up to 80 millimeters); a flexible production module for resistance spot welding based on PR601/60 robots (the precision of positioning is 1 millimeter, the number of degrees of mobility is 6); a chuck and shaft lathe flexible production module (the diameter of the item being machined above the bed is 320 millimeters); a system of the automated monitoring and control of a single-roll mill for the production of amorphous steels and alloys (it ensures a decrease of the thickness allowance of strip to one-half to two-thirds); an automatic manipulator for the loading and unloading of panel parts of furniture with a lifting capacity of 80 kilograms (the precision of positioning is within the range of 5 millimeters); converters of linear and angular displacements for NC machine tools, and others. Assignments on the assimilation of new types of industrial products and advanced technologies, including flexible production modules and machining centers, automatic lines for machining and forging and pressing processes, rotary and rotary conveyor lines, industrial robots, vertical boring and turning and jig-boring machines, and others, were also included in the plan.

In the basic provisions of the Comprehensive Program of Scientific and Technical Progress of the CEMA Countries it is specified that the partners will develop direct relations between enterprises, associations, and scientific and technical organizations on the basis of the provisions, which have been adopted in specific bilateral and multilateral agreements and contracts, which is an effective means of developing cooperation.

The establishment of joint scientific and technical associations and production associations, international engineering and technological centers, and so on is also envisaged. At present the first international machine tool building scientific production associations based on the Ivanovo Association imeni 50-letiya SSSR and the Plant of Metal-Cutting Machine Tools in Sofia (Bulgaria) and on the basis of the Moscow Krasnyy proletariy Association (the USSR) and the Beroye Scientific Production Enterprise (Bulgaria) have already begun to operate. The Soviet-Czechoslovak Robot International Association in the city of Presov and the temporary Soviet-Czechoslovak scientific and technical collective for the development of a general-purpose modular "artificial kidney," which was established on the basis of a contract between the All-Union Scientific Research Institute of Medical Instrument Building (the USSR) and the Chirana Concern (the CSSR), are operating successfully. Contracts have been concluded between the All-Union Scientific Research Institute of Medical Instrument Building (the USSR) and the Medicor Firm (Hungary) on the organization of the Mikromed Joint Enterprise for the production and marketing of modern items of medical equipment with the use of microelectronics and on direct scientific and technical ties between the NIIKhimmash Scientific Production Association and the Vegyterv Enterprise (Hungary).

In all in the area of machine building, in conformity with the intergovernmental agreements signed during the 42d meeting of the CEMA Session, 7 joint enterprises, 17 international associations, and 19 international organizations (design bureaus, scientific research institutes, laboratories) will be established with the participation of Soviet organizations and direct ties will be established between 196 Soviet organizations and 247 organizations of the CEMA member countries. However, the serious shortcomings in the implementation of the understandings do not make it possible to recognize as satisfactory the activity of a number of machine building ministries.

The understanding of the CEMA member countries on concerted actions on the development and use of fundamentally new types of equipment and technology by the concentration of their efforts and the organization of close comprehensive cooperation is the basis for the work on the implementation of the Comprehensive Program of Scientific and Technical Progress of the CEMA Member Countries to 2000. In this connection the tasks of developing not only individual models, but also entire ranges and systems of machines, equipment, and instruments face the main organizations (coordinators) and their coperformers. The devices being developed should satisfy the requirements of power, information, metrological, design, and operating compatibility and afford the possibility of forming diverse systems on the basis of a limited set of standardized blocks, modules, assemblies, and parts. This will serve as a prerequisite for production cooperation of a greater scale.

The extensive use of the latest achievements of science and technology (including microelectronics, fiber optics, laser technology, and others) stimulates the increase of the range of items of machine building, the rationalization of production requires the establishment of specific limits of it. In this connection the concerted actions of the socialist countries on the standardization and unification of items and the establishment of efficient series and long-range parameters are becoming very urgent. The need for the closer interaction of not only the technical and production potentials, but also the scientific potentials of our countries is a direct consequence of this.

The successful accomplishment of the assignments of the Comprehensive Program of Scientific and Technical Progress of the CEMA Member Countries to 2000 will ensure the large-scale integrated automation and mechanization of the sectors of the national economy and the substantial increase of the level of their electronization and will make it possible to completely retool the production base of machine building, to increase labor productivity drastically, and to increase the efficiency of social production.

Specific steps, which are aimed at the large-scale integrated automation and mechanization of the sectors of the national economy, are envisaged by the Basic Directions of USSR Economic and Social Development for 1986-1990 and the Period to 2000. Flexible adjustable systems and computer-aided design systems, automatic

lines, machines and equipment with built-in microprocessor hardware, multiple-operation NC machine tools, and robotic, rotary, and rotary conveyor complexes will be introduced extensively in the machine building complex.

In the machine tool and tool building industry the leading production of NC metal-cutting machine tools, machine tools like the "machining center," equipment for the automation of the assembly of mass items in machine building, and rotary, rotary conveyor, and other automatic lines for machine building and metal working is planned. The production of automated and robotized complexes and lines, flexible production systems of metal working, including for sheet stamping and die forging, the manufacture of parts made of metal powders, plastics, and other materials, and modern measuring aids of the automation of control, will be increased.

In heavy and transport machine building it is envisaged to change over from the production of individual machines to the development of technological lines and complexes. The production of means of the mechanization and automation of materials handling, loading and unloading, and warehousing operations for the purpose of significantly reducing the use of manual, unskilled, and difficult physical labor will increase substantially.

In chemical and petroleum machine building the output of automated lines for the production of methanol, carbamide, ethylene and propylene, synthetic rubbers, and others will increase.

In instrument making it is planned to produce at a leading pace highly reliable systems of industrial automation based on electronics, first of all for the control of technological processes, means of the automation of engineering labor, small high-performance computers, personal computers, NC systems for functional machine tools and flexible production modules, programmable master controllers for various types of equipment, and aids for computer hardware and automated control systems.

In the electrical equipment industry highly automated electric motor works will be developed more rapidly, the production of automated electric drives, storage batteries, electric loaders, components for flexible production systems, industrial robots, and other hardware, which is necessary for automation and mechanization in the sectors of the national economy, will increase.

In construction, road, and municipal machine building attention will be focused first of all on the production of machines, devices, and tools, which make it possible to decrease sharply the use of manual labor and to ensure the complete mechanization of construction processes, and on the expansion of the range and the increase of the output of highly mechanized complexes for logging operations.

In machine building for light and food industry it is planned to develop and to begin the production of complexes and systems of machines, which ensure the changeover to the complete mechanization and automation of the manufacturing of products in light and the food industry, as well as to expand the output of highly efficient machines and equipment, which are furnished with robotized devices and microprocessors.

The Prospects of Cooperation With Foreign Countries in the Area of Machine Building

The development of cooperation with foreign countries in the area of machine building has to be raised to a qualitatively new level on the basis of the comprehensive solution of the problems, which are connected with the meeting of the need of the national economy for machines, equipment, and instruments and with the development, devising, and production of fundamentally new types of equipment, which conform to the world technical level.

The structure of foreign trade exchange with CEMA member countries, which is inefficient for the USSR, has to be reorganized. For this it will be necessary to increase the average annual growth rate of Soviet exports of machines and equipment and to increase sharply the level and quality of reciprocally delivered machines and equipment. The imports of machines and equipment will increase during this period by approximately twofold.

Within the framework of the restructuring of USSR foreign economic relations with European socialist states it is necessary to perform work on the reorientation of their specialization mainly toward the production of nonmetal-consuming and science-intensive types of modern equipment. The importing of machines and equipment from the fraternal countries for the retooling and modernization of domestic enterprises should be carried out mainly in the form of deliveries of complete sets. Moreover, during the coming period the cooperation of the USSR with the CEMA member countries, which is aimed at the reduction or halt of the importing from capitalist countries of individual types of machines and equipment, should be expanded. It will be necessary to focus attention on the assimilation of the production of modern highly productive equipment, which previously was purchased in capitalist countries, by purchases of licenses, which have been coordinated with the fraternal countries, and the organization of joint enterprises.

The work on the increase of the technical level and quality of reciprocally delivered products should be improved radically on the basis of the further improvement of the scientific and technical cooperation of the CEMA member countries, the strengthening of its interconnection with production cooperation, and the leading development of standard hardware. It is planned to reform the system of the international specialization and cooperation of production. The interaction of Soviet

associations, enterprises, and organizations with partners from the CEMA member countries on the basis of cooperation in research and development, the coordination of investments, and the coordination of production programs and questions of marketing and maintenance will be purposefully developed. The coordination of economic and science and technology policy in machine building and its sectors at the level of ministries and departments will be continued.

Particular attention will be devoted to the development of large-scale forms of cooperative collaboration on the basis of the formation of international production and scientific production complexes in the CEMA member countries, which are connected with the organization of mass and efficient production and with the development of the export potential for appearance on the markets of developed capitalist countries. In the future it is necessary to ensure the significant increase of the efficiency of sectorial cooperation, which should be based on programs of long-term development, which have been agreed upon by the countries.

The sectorial programs should combine optimally the interests of the USSR with the formed specialization of the countries:

—Bulgaria—materials handling and agricultural machine building, machine tool building, computer hardware, and special technological equipment for the electronics industry;

—Hungary—the production of buses, instrument making, medical equipment, computer hardware, the production of communications facilities and equipment for the service sphere; special technological equipment and instrumentation for the electronics industry;

—the GDR—metallurgical and mining equipment, chemical and printing machine building, machine tool building, robot building, and shipbuilding, optics and items of electronic engineering, computer hardware, light and food machine building, special technological equipment for the electronics industry, and the production of railroad refrigerator and passenger cars;

—Poland—mining machine building, the production of equipment for the garment and food industries, the production of road building machinery, tractors, and passenger cars, and shipbuilding;

—Romania—the production of equipment for the recovery of petroleum and gas, the production of railroad freight and mail cars;

—Czechoslovakia—machine tool building, the production of light and heavy trucks, diesel locomotive and electric locomotive building, the production of power, atomic, and metallurgical equipment, equipment for light and food industry and medicine, electronic engineering items, and special technological equipment for the electronics industry.

The commodity structure of exports and imports has to be changed radically, the quality and competitive ability of domestic machines and equipment have to be raised, the responsibility of ministries, departments, associations, and enterprises for the implementation of commercial economic and scientific economic relations with capitalist countries has to be increased. It is proposed to expand these relations on the basis of the principles of cooperation and to establish joint enterprises with the participation of Soviet and capitalist organizations, firms, and management organs. It is planned to ensure the priority of purchases of advanced equipment, devices, single-design units, and machine tools for finishing operations, as well as stand equipment and instruments for scientific and laboratory research. It is envisaged to halt the purchases of technically simple equipment and to organize its production both at domestic enterprises and at enterprises of the CEMA member countries (all this will be taken into account in the work on the coordination of plans).

The expansion of the development of cooperative relations should become one of the key directions of the intensification of cooperation with developed countries. The consistent implementation of coordinated long-term programs of commercial, economic, scientific, and technical relations with these countries will be continued, the scale of the work on the importing of licenses in close interconnection with the importing of machines and equipment will be broadened significantly.

The implementation of the conceptual measures in the area of the development of foreign economic relations with foreign countries will promote:

—the large-scale integrated automation of the sectors of the national economy, the complete retooling of the production base of machine building, and the introduction of advanced technologies;

—the increase of the productivity of national labor;

—the output of all machine building products at the world technical level;

—the substantial strengthening of the technical and economic independence of the countries of the socialist community from imports from capitalist countries;

—the reform of the structure of foreign trade exchange, which is inefficient for the USSR, and the significant increase of the export of machines and equipment;

—the extensive introduction of new advanced forms of cooperation, the broadening and intensification of the specialization and cooperation of production, and the significant increase of reciprocal deliveries of component assemblies and parts;

—the meeting for the most part of the need of the most important sectors of the national economy for machine building products.

While giving priority to economic cooperation with the socialist countries, during the coming period it is also planned to expand commercial economic and scientific and technical relations with all interested countries regardless of their socioeconomic system on a stable, mutually advantageous, and strictly balanced basis.

Footnotes

1. The countries of the socialist community account for 25-30 percent of the volume of the world production of machines and equipment. From 30 to 40 percent of the number of personnel of industry are employed in the sectors of machine building.

2. *Pravda*, 26 June 1987.

3. *Pravda*, 26 June 1987.

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New Forms of Science-Production Integration in CEMA

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[Article by Candidate of Technical Sciences A.A. Khachaturyan under the rubric "Scientific and Technical Progress: Problems of Acceleration": "New Forms of the Integration of Science and Production. From the Experience of the European CEMA Countries"]

[Text] In recent years in the CEMA member countries an extensive search has been under way for the most effective organizational forms and methods, which make it possible to expedite the development and introduction in production of new equipment and technology and to link scientific research and development more closely with the needs of social production.

With the industrialization of science and the increase of the comprehensiveness of research the very place of the individual scientific institution in the overall structure of science and in scientific and technical progress is changing and the notion of the institute as the basic organizational unit of this process is being revised. In the system of sectorial science the scientific research institute is losing independence, turning into a component of new organizational systems—scientific production organizations in Bulgaria, combines in the GDR, scientific production associations in the USSR, and so forth, which encompass simultaneously a number of stages of the scientific and technical cycle. Frequently the scientific unit holds the leading position in them. Then scientific tasks acquire priority over purely production tasks. As experience shows, it is most advisable to establish such complexes in those instances, when the obtained development has extensive possibilities for duplication and a large potential scale of introduction. In other instances scientific production complexes not with a research emphasis, but with a production emphasis, which also include the series production of a new product, are more advisable. There the leading role belongs to the production unit. In a number of instances integration encompasses not only science and production, but also the organization of the comprehensive service of the consumer. Such, for example, are the industrial combines in the GDR, which implement practically the entire reproduction cycle.

As a rule, the industrial combine is a large association of economically and legally independent enterprises with a closed production cycle and a high degree of the concentration, specialization, and cooperation of production. It usually unites 15-20 enterprises with from 5,000 to 50,000 people. The combines in the GDR are the basic unit of economic management. They are fully responsible for the meeting of the needs of the national economy for a specific product. Research and development, series production, powerful subdivisions for the production of means of rationalization, construction and installation enterprises and sections, marketing organizations (including foreign trade organizations), and maintenance organizations are united under a common management. Such a structure creates the conditions for the pursuit of a unified science and technology policy, and first of all for the balanced and interconnected scientific and technical development of all the enterprises of the combine.

The concentration of the basic potential of research and development in combines helps, as they believe in the GDR, to overcome disunity and departmentalism in the sphere of scientific research and brings its structure as close as possible to the structure of production. This ensures the unity of management of the process of research, development, and introduction. At combines basic research is conducted at a quite high level in the interests of entire sectors. Powerful scientific, scientific and technical, and technological centers and special planning and introducing enterprises have been established at many large combines. Close cooperation has been established with academic institutes, universities, and higher educational institutions, as well as between the scientific and technical units of various ministries, departments, and combines. The practice of establishing large centers in science-intensive sectors has given an especially good account of itself.

The scientific potential of combines is concentrated, as a rule, in large scientific research centers. Within them there are research subdivisions, planning and design bureaus, pilot and experimental works, as well as subdivisions for the training and the increase of the skills of personnel. At the leading combines up to 10 percent of the workers are employed in the sphere of research and development (for industry as a whole this indicator comes to 3.5 percent). The responsibility for the planning and management of scientific and technical progress at combines, for the development of new equipment and technology, and for scientific and technical cooperation with CEMA member countries has been assigned to the centers.

One of the most important problems of such "massed" integration of science and production is the observation of the optimum scale of the concentration of the sectorial scientific and technical potential in large production economic associations. Excessive concentration, for example, can turn into a monopoly which eliminates creative competition, which will decrease substantially the effectiveness of such organizational forms.

Moreover, the inclusion of the sectorial scientific and technical potential within large production economic units in itself does not yet signify the effective settlement of all the questions of the organizational support of the scientific and technical development of industry.

The objective pressure of current production needs, to which sectorial science is inevitably subjected under the conditions of organizational convergence with production, is also becoming a source of many difficulties. It is possible, apparently, to surmount these difficulties only by means of special steps, which ensure priority in case of choice, development, and introduction to fundamentally new technical solutions that are especially important for the development of production. Special forms of the organizational and economic regulation of the scale and ratio of basic and applied research within sectorial science are needed for this. Purely cost accounting forms and departmental administrative influences are insufficient here.

The integration of science and production within large production economic units (scientific production associations, combines, associations, and others) most often leads to the increase of the item specialization of scientific units, to the decrease of the scale of research work, and to the sharp increase of the amount of design and technological development: for all the activity of such associations is subordinate to the obtaining of an entirely specific final product and is evaluated in terms of the quantitative and qualitative indicators of this product. But in case of such an increase of the item specialization of sectorial science, as the experience of the fraternal countries shows, it is possible to lose the universality that is necessary for scientific research. The losses are especially great, if powerful research organizations are transferred to production units.

On the other hand, the organizational unification of scientific and technical units and production units in itself does not yet guarantee the necessary integration of science with production. The equipment being developed becomes more complex, and more and more participants have to be enlisted in the development and assimilation of innovations. The results of the work often have to be duplicated outside the organizational structure, in which they were obtained. Due to this in recent years in the CEMA member countries the direct organizational combination of science and production has been supplemented more and more often with various forms of coordination and the contractual cooperation of scientific and technical organizations and production organizations, which does not infringe upon their legal independence, as well as with the extension of cost accounting relations to the interaction of science with production.

Contractual relations are most widespread among the immediate participants in the scientific and technical cycle—scientific research institutes, planning, technical, and introducing organizations, and enterprises which introduce technical innovations. At the same time sectorial ministries, departments, and centralized organs of the management of scientific and technical progress also frequently participate in contractual interactions. The practical experience of the CEMA member countries shows that contracts make it possible to ensure the dynamicness and flexibility of interrelations and to coordinate the economic interests of the participants in the innovation cycle.

The specific forms of the contractual integration of science and production can be most diverse: associations, unions, companies, voluntary associations, joint enterprises for technical development, and so forth. All these forms "add on to" the organizational structure of the management of scientific and technical development and supplement it with objectively necessary elements, which are not envisaged or are insufficiently effective within the existing organizational structure.

In Bulgaria, for example at the beginning of 1985 there were more than 200 such associations. Enterprises, institutions, banks, scientific research institutes, and design bureaus regardless of their sectorial, departmental, or territorial affiliation can be members of them. The associations unite the efforts of their members not only in the fulfillment of research and development, but also in their financing and technical supply, in the establishment of new works, and so forth. The enterprises and organizations, which are a part of an association, retain their legal independence; they can simultaneously be members of several associations.

The contract specifies the goals, tasks, and sphere of activity of the association, the fixed capital and the amount of the shares of the founding members, the rights and duties of the members, as well as the obligations of

the association with respect to its members, the organization of management and the procedure of decision making, and the procedure of distributing the profits and losses.

Among the most effective ones it is possible to single out the Progress Economic Trust, of which the scientific production combine of instrument making and specialized technological equipment, the Higher Institute of Electrical and Mechanical Engineering in Gabrovo, as well as a number of economic organizations of machine building are a part. The goal of the trust is the development of cooperation in scientific and technical activity and the rapid introduction of its results. For this the members of the trust coordinate their plans of scientific and technical progress, jointly accomplish planning tasks, make available to each other on a contractual basis the necessary resources and equipment, and enlist scientists and specialists from the partner organizations, as well as from the Bulgarian Academy of Sciences, higher educational institutions, and engineering introducing organizations. Within the framework of its tasks the trust conducts the necessary research and development, draws up planning and technical documentation, produces prototypes and tools, and introduces the developed equipment in mass production. In other words, it ensures on a cooperative basis the interconnected realization of all the stages of the innovation cycle. According to the estimates of specialists, the additional impact from the activity of the trust is equivalent to the results of the work of an entire engineering introducing organization with a staff of about 200.[1]

Forms of cooperation of this sort are especially developed where it is necessary to bring close to the needs of production the basic and applied research, which is being conducted at academic institutes.

Due to the significant risk and uncertainty of research work the forms of the convergence of academic science and production in most cases cannot be strictly regulated. Therefore, for research work the much less strict coordination and cooperation of scientific, technical, and production activity are the dominant form of integration with production. It is regulated mainly by contracts on creative cooperation.

In the GDR, for example, the cooperation of academic institutes and higher educational institutions with combines is legalized by a so-called comprehensive contract between two or several partners, in which the relations in such areas as the training and the increase of the skills of personnel, the conducting of research and the implementation of its results in production, the development of a joint patent and license strategy, the exchange of personnel, the establishment and use of a common material and technical base of research, and the implementation of measures of a political, social, and cultural nature are specified for a long period. By early 1985 nearly 200 such contracts had been concluded between the higher school and enterprises of industry. Institutes of the Academy of Sciences are conducting research on a contractual basis with more than 40 percent of the combines of central subordination. About 30 higher educational institutions have signed more than 130 comprehensive contracts with combines.[2]

At present in the GDR associations of academic institutes and higher educational institutions with industrial combines, territorial scientific and technical associations (cooperative unions), scientific research associations, which include experimental shops and laboratories, with the task of producing trial output (in the GDR they are called technikums), and joint temporary collectives are being formed on the basis of contracts.

One of the promising directions of the cooperation of combines with institutions of the GDR Academy of Sciences and higher educational institutions is the organization of complexes for the joint use on a contractual basis of the available scientific potential. The goals of such associations are more limited, while cooperation is regulated more strictly than in case of contracts on creative cooperation. In 1976 the first such complex for drugs was organized. Now another four complexes have been established: in the area of technical microbiology, the principles of the use of organic high polymer compounds, organic synthesis, and atomic engineering. As a rule, the community or the mutually complementary nature of the tasks, a tradition of contacts, the possibility of the joint use of available equipment, territorial proximity, and mutual interest in cooperation are the prerequisite for the establishment of such unions. The relations of the partners are legalized on the basis of economic contracts. A scientific council of managers and specialists of the cooperating organizations is established for management.

Owing to such cooperation academic developments undergo quick checking at the pilot works of combines, while the combines through their representatives, who participate in joint research collectives, monitor the performance of this work.

Such associations have just begun to be formed between higher educational institutions and combines. The first complex included five combines of the chemical industry and the Technical College in Leuna-Merseburg.

Usually the cooperation between combines and higher educational institutions is developed within the framework of regional relations. Up to 40 percent of the scientific personnel of the higher school are engaged in research and development for the needs of industry, but this cooperation is not confined to research and development. Scientists and students undergo practical training at combines, while specialists from industry undergo it at higher educational institutions; specialists of the higher school organize consultation centers for workers of industry and provide them with information on national and foreign know-how in the field of new equipment and technology.

The exchange of specialists helps to speed up the assimilation of the results of work. Annually about 200 research specialists are sent from the system of the GDR Academy of Sciences to industry, 40 percent of them are sent for a period of more than a year. About 100 people are sent annually from combines to the system of the Academy of Sciences, nearly all of them are sent for more than a year.

Such extensive development of the scientific and technical relations of combines with research institutions and higher educational institutions in many respects is explained by the system of the monitoring of the scientific and technical level of products, which is in effect in the GDR. All combine plans of research and development and the updating of production—and the time of the updating of products in the GDR is very strict—undergo careful state examination. If the parameters of planned new items do not conform to the world level or do not anticipate very drastic improvements as compared with those being produced, the drafts are returned for modification. A special system of stimulation gives incentives for the scientific and technical level of a product and, accordingly, the "quality" of research and development, as well as the acceleration and the reduction of the cost of scientific research and experimental design work, by whatever means it is achieved. The amounts of the material incentive are very large and are comparable to the basic salaries of specialists. Such stimulation of the end result instead of its intermediate stages and individual phases interests combine scientific research institutes and design bureaus in the maximum use of "outside" ideas, specialists, and so forth and does not allow departmental ambitions to be developed, while the very broad economic independence of the participants facilitates the establishment of the necessary contacts.

In 1985 the task of strengthening the interconnection of academic and VUZ science with production was posed at the 10th SED Central Committee Plenum. In conformity with the decisions of the plenum a new economic organizational mechanism of their interaction began to operate as of 1 February 1986.

Economic contractual financing is becoming the preferred form of the financing of basic and applied research of the academy and higher educational institutions. The share of economic contractual operations in the total amount of natural science and technical research should increase to 70 percent. The economic contractual relations between academic organizations, higher educational institutions, and combines should be organized on a long-term basis, should be profitable to both parties, and should be legalized within "coordination economic contracts." A contract cost of work, as well as a "research markup," the amount of which depends on the scientific and technical level and the economic efficiency of the result of research, are established for economic contractual scientific research work.

The role of the economic stimulation of academic and VUZ research, which is performed in accordance with the orders of combines, is increasing.

The coordination contract specifies the most important areas of scientific and technical cooperation and measures on the training and exchange of personnel, on material and technical supply and the rationalization of the processes of research and introduction, on the coordination of the planning and management of research and development, on the formulation of joint research strategies, and so on.

In the coordination contracts of higher educational institutions with combines, moreover, concerted measures on the conducting of student practical work, on the specification of the themes for graduation projects, on the inclusion of students in research collectives, and on participation in other joint measures are envisaged. In special contracts, which specify the assignments on research and development, the specific tasks, the scientific, technical, and economic goals, the stages of the work, and the type and forms of the result of research and development—the amount of the expenditures, the forms and times of remuneration, and the conditions of the payment of the research markup—are stipulated.

The goals and results of the research and development of the Academy of Sciences and higher educational institutions should be "defended" in specially established commissions (councils), which include representatives of the client combines. The commissions make decisions on the level of achievement of the planned goals, on the introduction of the results, on the moral and material stimulation of scientists, and so forth. Under the conditions of the considerable dependence of the remuneration of the labor of the participants on the end result, which is subject to strict extradepartmental evaluation, discussions of this sort are by no means of a formal nature.

Special units—intermediaries—are beginning to play a greater and greater role in the quick assimilation and dissemination of innovations in industry. Specialized enterprises for technical development and introducing organizations, whose activity as if fills in the joints between the phases of research and development and the initial introduction and mass industrial assimilation of new equipment, often perform this role.

In Hungary, for example, during 1981-1983 a new organizational form of the integration of science and production—enterprises for technical development—emerged. At the beginning of 1985 there were more than 100 such enterprises in industry of the country.

The enterprise for technical development performs the role of an intermediary between scientific research institutes and production organizations, but if necessary also assumes the functions of a "manager"—the organizer and immediate supervisor of the work on introduction.

But their basic task is the search for promising technical innovations, the study of the possibilities of their dissemination, the determination of the group of potential users, and the promotion of introduction. The selected developments are brought up to a stage which makes it possible to proceed directly to production. If necessary the enterprises for technical development can also act as general contractors. The new "engineering" firms engage in Hungary in all types of activity, which are necessary for efficient technical development: research, experimental design, planning, expert consultation, organizational and coordinating, and entrepreneurial activity, thereby monitoring all the stages of an innovation. A special interdepartmental working group of specialists in engineering, of which representatives of sectorial and functional departments, banks, and the Hungarian Central Statistical Office are members, supervises them.

At present several types of enterprises for technical development are prevalent in Hungary: institutions which were established on the basis of scientific research institutes during their reorganization (there are 10 such institutions); scientific research subdivisions, which were separated from their enterprises and were transformed into independent subsidiary organizations, which use, however, the technical base of the main enterprise (there are about 15 of them); small independent enterprises and cooperatives, which include several engineers and economic specialists and the necessary technical personnel and, as a rule, are established for the implementation of some already existing scientific idea—the majority are enterprises of this sort; various societies and interdepartmental enterprises for technical development with the rights of an independent legal entity.

Scientific and technical cooperatives have secured their place among small institutions in Hungary. A condition of membership in such a cooperative is personal participation in its work, as well as a monetary contribution in the amount of not less than the wage for 2 months of the member of the cooperative. The initial capital of the cooperative, as a rule, is small, but its members always have high scientific and technical skills. Thus, the Datoplan Cooperative, which was established for the modernization and maintenance of computer hardware, in 1985 had 34 shareholders and 9 permanent employees. Moreover, in 3 years it hired about 100 people for one-time jobs. For the most part the members of the cooperative are experienced, highly skilled engineers, mathematicians, and technicians. Patents for inventions, which are used by the cooperative, belong to several of them. New inventions, which have been made after joining the cooperative, become its property.

All its staff members have salaries in accordance with the manning table, which are paid as an advance. At the end of the year, with allowance made for the achieved results, final settlement is made. Here the cooperative itself decides how to spend the amounts that are left after the payment of the tax: for remuneration or for the purchase of new equipment, construction, and so forth. Despite the fact that the wage of the members of the cooperative is higher than that of employees of large enterprises, its services are half as expensive as those of Videoton—the main Hungarian firm, which produces and maintains computer hardware. Starting in 1985 Datoplan began to deliver to the USSR an electronic memory for the modernization of the Hungarian-produced YeS-1010 and YeS-1011 computers. In each of the 3 years of existence of the cooperative its turnover has doubled, the profit has increased by threefold.

The effectiveness of other enterprises for technical development is also high. As a whole during the period of 1983-1984 the specific profit per worker of such enterprises, which were established on the basis of scientific research institutes, exceeded by 20 percent the same indicator in the cost accounting scientific research subdivisions of production enterprises. The indicators of companies are even higher: with a smaller capital-output ratio per worker they achieved a larger specific profit. In the specific profit subsidiary enterprises for technical development lead the main enterprises substantially.

Another new organizational form of research activity in Hungary is also interesting—the establishment of so-called framework scientific research institutes, the number of staff members of which varies flexibly subject to the specific assignment. The permanent staff of such scientific research institutes is small: for the most part these are the administrative and management personnel and the staff members of the service subdivisions. As a rule, all the basic specialists are hired for work in temporary problem groups by competition for the period to the completion of research. During this period the contact of scientists with their basic place of work is maintained, but they receive their wage at the "framework" institute. The "framework" institutes are called upon to stimulate the introduction of scientific results at small and medium organizations, which cannot maintain a permanent staff of highly skilled specialists of different types. The advantage of this form, in the opinion of Hungarian specialists, consists first of all in the opportunity to enlist a broader group of scientists in the most important scientific developments and to use more purposefully the scientific and technical potential of the country.[3]

The possibility of the flexible formation of working research groups is a new important feature in the organization of research and development. Other types of institutions have also received the opportunity to hire nonstaff specialists temporarily. Such changes also strengthen interdisciplinary cooperation. In Hungary the question of the direct financing of flexible research collectives, in the activity of which representatives of the client, staff members of the performing institute, and workers of trade organizations participate, is on the agenda. The manager of such a group performs his duties only until the expiration of the term of the contract, that is, until the practical introduction of the results of

research. In case of such a system the collective organization of work is combined with financing for the theme and a competitive system of selection.

Such an approach also received its embodiment in Bulgaria in the organization of the activity of "program collectives." The "program collective" is becoming not simply a form of the organizational combination of science with production, but also an economic unit, which bears economic responsibility for the entire process of the development and introduction of new equipment. The interests of all the participants in the program collective are connected not only with the results of their specific work, but also with the results of the introduction of the equipment, which was developed with their participation, at enterprises of the country.

The right of establishing such collectives is granted to the state organ and to the economic or scientific organization. The relations between the program collective and other organizations are based on economic contracts. When working on especially important scientific and technical tasks it is proposed to use the competitive approach extensively, in order to assign the accomplishment of the task to that one of the collectives, which submits the best project. For the stimulation of the competitive element it is proposed when working on especially important tasks to form simultaneously several "program collectives." The work of the collectives will be organized on a cost accounting basis, they will be granted the right to form their own funds from the revenues. The "program collectives" will distribute the wage fund among their members independently, subject to the contribution of each participant in the work.

In 1986 work was begun in Bulgaria on the establishment of a network of technological centers and technological institutes in specific directions. The basic task of the centers is the extensive development and use of standard integrated technologies. In several areas, in which interesting achievements that require additional technological research have been obtained, special technological institutes will be established on the basis of operating scientific research institutes.

The principles of competitiveness are beginning to be used more and more widely in the CEMA countries in the organization and financing of basic and applied research. In Hungary, for example, a system of the competitive financing of research has been used since 1983. Starting in 1986 the all-Hungarian research fund began to operate here. During the current five-year plan it is planned to allocate about 4 billion forints from this fund for the distribution on a competitive basis of capital for the financing of the most important basic research.[4] The thematic competition for the obtaining of capital from this fund was announced in December 1985. About 2,000 applications, which were submitted both by individual researchers and by various research collectives and companies, were made. In all more than 3,600 scientists were busy in the competition.

For participation in the competition the themes were submitted in the form of a plan of the conducting of research and development. The applications were considered by a special bureau of the research fund attached to the Institute for the Organization of Science of the Hungarian Academy of Sciences with the participation of leading scientists and statesmen. The fundamental nature of the theme proposed for development, its importance and place in the corresponding themes, the scientific achievements of the participants in the competition, and the soundness of the amount of requested capital and the time of completion of the work were evaluated. After discussion in the bureau the applications were turned over for consideration to commissions headed by the vice presidents of the academy, while the final decision was made by the presidium of the academy.

The use of the granted subsidy in practice is not dependent on any conditions, except one: not more than half of the granted amount can be used for investments. Within the allocated total amount all types of expenditures can be redistributed during the entire period of the elaboration of the theme, which is specified by the contract. In the organization of the competition the lack of age and job restrictions for its participants is especially emphasized. This contributed to the interest of young scientists in it: the authors of 95 percent of the works, which were declared winners in the competition, are less than 40 years old.

Thus, given all the diversity of the forms and methods, which are being used in the CEMA member countries for bringing science closer to the needs of production, two common interconnected tendencies are characteristic of them all. First, all kinds of administrative and economic restrictions and departmental barriers, which check the initiative of scientists, engineers, and production workers, are being eliminated. Even where the organizational departmental structure becomes as if more rigid and where the formal uniting of previously independent participants in the process occurs—as at the combines of the GDR (whose structural units, incidentally, enjoy quite extensive independence), this rigidity is offset by the extensive dissemination of horizontal relations, which do not depend in any way on the departmental affiliation of the participants. Second, economic conditions, which interest all the participants in scientific and technical progress in the end result, and not in various intermediate stages and formal indicators, are being created. Everything that we have written about is probably just the beginning of this very important process.

Of course, convergence of this sort should also have its limits—otherwise the risk of the erosion of basic research, its orientation exclusively toward specific, immediate needs, and, in the end, the stagnation of science will arise. Thus, in our country the too extensive dissemination of economic contractual work at academic institutes has already turned into a focus on petty

topics and above a certain limit is recognized as inadvisable. In order to prevent such a development of events, special steps of both an organizational and a financial nature, particularly the preservation of the achieved level of state budget financing of basic research and the maintenance of its prestige, may be required. But that part of the scientific potential, including basic research, which is called upon to meet the more immediate needs of practice, should be used as efficiently as possible. And here the new forms of the organization and support of work are called upon to play a decisive role.

Footnotes

1. P. Zlatarov and B. Ganev, "Assotsiatsii sotsialisticheskikh organizatsiy v NRB" [Associations of Socialist Organizations in Bulgaria], Moscow, 1986, p 63.

2. *Einheit*, No 3, 1983, p 405.

3. *Gazdasag*, No 2, 19 February 1984, p 31.

4. *Magyar Tudomany*, No 6, 1985, p 416.

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Restoration of Ties Between USSR and China's Academies of Sciences

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 4, Apr 87 pp 121-122

[Article by I.A. Surinov: "Restoration of Scientific Ties with China's Academies of Sciences"]

[Text] In recent years, representatives of the USSR Academy of Sciences, the Academy of Sciences of China and the Academy of Social Sciences of China, taking into account the obvious mutual interest in development of contacts between scientists of the Soviet Union and of the People's Republic of China, undertook a number of get-acquainted trips. They confirmed the point of view that in the interest of both sides the fruitful scientific ties that had been terminated more than 20 years ago should be restored in the shortest time possible.

At the invitation of the USSR Academy of Sciences, a delegation headed by Professor Hu Yongchang, deputy secretary of the Academy of Sciences of China, visited the Soviet Union in December 1985. On the Soviet side, the delegation was headed by Academician G.K. Skryabin, chief academic secretary of the Presidium of the USSR Academy of Sciences. The participants of the talks were unanimous in the fact that it would be advantageous to establish in a short time mutually beneficial relations with equal rights between the two academies. An agreement was reached to arrange for new talks in Beijing in 1986 and to sign there an Agreement and Plan of Scientific Cooperation.

These talks were held in June 1986, when a delegation headed by Academician G.K. Skryabin visited the People's Republic of China. It included Academician A.A. Bayev, Academician Yu.A. Osipyan and Doctor of Geological and Mineralogical Sciences O.A. Bogatikov. The delegation of the Academy of Sciences of China was headed by Professor Gu Yijiang; its members included prominent Chinese scientists.

The delegation of the USSR Academy of Sciences was offered the opportunity of becoming acquainted with the academic scientific institutions of the physical, biological and geological type in Beijing and Shanghai and with historical and cultural places of note. The Soviet representatives were kindly welcomed in all of the institutions. All the Chinese scientists in their talks with members of the delegation from the USSR Academy of Sciences spoke of their sincere desire to develop fruitful cooperation with their Soviet colleagues.

On 26 June 1986, the heads of the delegations signed without a time limit an Agreement on Scientific Cooperation between the USSR Academy of Sciences and the Academy of Sciences of Chine and a Plan of Cooperation between them for 1987-1988. There were present at the signing USSR Ambassador to the People's Republic of China O.Ya. Troyanovskiy and President of the Academy of Sciences of China Academician Lu Jiaxi, who then had a talk with members of the USSR Academy of Sciences's delegation.

That same day, the Soviet academic delegation was received by Politburo member of the Central Committe of the Chinese Communist Party Fang Yi, who discussed with the Soviet scientists prospects of development of scientific cooperation. O.A. Troyanovskiy took part in the talk.

The signed agreement is a good legal basis for an all-round development of scientific cooperation in all fields of the natural and technical sciences. They plan regular signing of plans of cooperation with an indication of specific scientific subject matter and cooperation of academic libraries and information centers.

On the basis of the signed Plan of Scientific Cooperation Between the USSR Academy of Sciences and the Academy of Sciences of China, the academies are organizing for 1987-1988 trips of scientists for scientific work, consultations and exchange of experience, familiarization with scientific research, upgrading of qualifications and reading of lectures and reports as well as participation in conferences and other scientific measures. Institutes of both academies will accept young specialists for graduate study and for probational work. The parties reached an agreement to conduct in 1988 talks and to sign a Plan of Cooperation for the subsequent period.

Contacts were restored between scientists of the two countries in the field of the social sciences. A most significant event was a visit to the Soviet Union in May

1986 on invitation by the USSR Academy of Sciences of a delegation from the Academy of Social Sciences of China headed by Deputy General Secretary Ding Weizhi. The Chinese guests had a broad exchange of opinion on the content and forms of cooperation of social scientists of the two countries. The delegation of Soviet scientists was headed by Academician Yu.V. Bromley, deputy academic secretary of the Presidium of the USSR Academy of Sciences.

The heads of the delegations signed a Protocol, in accordance with which academies of both countries in the course of the year would organize an exchange of scientists in the field of history, philosophy, law, eocnomics, literary study and linguistics.

The parties agreed to continue talks on cooperation in Beijing, where a delegation of the USSR Academy of Sciences would come in the first half of 1987 on invitation of the Academy of Social Sciences of China.

Contacts and talks between representatives of the USSR Academy of Sciences, the Academy of Sciences of China and the Academy of Social Sciences of Chine constitute an important contribution to the development of all-round mutually beneficial Soviet-Chinese ties.

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New Column to Discuss Foreign Economics, S&T Progress

18140091 Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 22 Nov 87 p 3

[Interview with Academician Yevgeniy Maksimovich Primakov, director of the Institute of World Economics and International Relations of the USSR Academy of Sciences, by Yu. Kirpichnikov, editor of the Department of Foreign Information of *Sotsialisticheskaya Industriya*, under the rubric "The Business Club: Economics and Scientific and Technical Progress Abroad": "From the Money Box of Foreign Experience"; date, place, and occasion not given; first paragraph is *Sotsialisticheskaya Industriya* introduction]

[Text] Under the conditions of restructuring the interest of our readers in the economics of foreign countries has increased sharply. It is necessary to imagine realistically those, with whom we are dealing and with whom we are conducting economic competition. Precisely such a dialectical view was characteristic of V.I. Lenin. The study of foreign experience and its use in the interests of the national economy of the Soviet Union are an urgent problem. The editorial board of *Sotsialisticheskaya Industriya* and the Institute of World Economics and International Relations of the USSR Academy of Sciences are commencing today "The Business Club: Economics and Scientific and Technical Progress Abroad." Academician Ye. Primakov, director of the Institute of World Economics and International Relations of the USSR Academy of Sciences, and Yu. Kirpichnikov, editor of the Department of Foreign Information of *Sotsialisticheskaya Industriya*, talk about the tasks and program of the club.

[Question] Yevgeniy Maksimovich, the interest of *Sotsialisticheskaya Industriya* in setting up permanent cooperation with the Institute of World Economics and International Relations in covering various aspects of economic life and scientific and technical progress abroad is quite understandable. It is pleasant that your institute responded with readiness to this proposal. But this matter, let us say frankly, is unusual for academic scientific research institutes. Would you perhaps say why you are agreeing to this?

[Answer] It would be possible to name many reasons, but, perhaps, the main one is the possibility of a direct outlet to practice. We wish that our work would be of specific benefit to the USSR national economy and would aid the solution of the most difficult problems of its restructuring.

We are studying the processes of the economic, scientific and technical, social, and political development of the countries of the nonsocialist world. An objective analysis and knowledge of what is happening abroad are our duty. But it would be a mistake to confine ourselves to purely academic research. Cooperation with the newspaper *Sotsialisticheskaya Industry* precisely affords the opportunity of a direct dialog with the multimillion audience of its readers and with those who are directly participating in industrial production.

And there is another circumstance, to which I personally attach great importance. It is no secret that the coverage of questions of economic life in our country and abroad on the pages of the Soviet press until recent times was very one-sided: here everything is fine, there everything is bad.

We emphasize the differences in the social systems and the criticism of capitalism and everything that is connected with it. This is entirely understandable and correct. At the same time one must not, obviously, divert attention from the fact that the development of productive forces occurs in many respects in conformity with laws which are common both to capitalism and to socialism. This common thing appears especially clearly when we take the organizational technological aspects of the development of production, the labor process, and so on. And it is clear that in literally every country, including a capitalist country, there are its own achievements in the development of productive forces. It is also

necessary to study and use them, of course, with allowance made for the real differences in production relations, and not to be ashamed to adopt what can also be useful for us. It is, of course, not a question of switching from excessive criticism to irrepressible enthusiasm.

Incidentally, the information on the economic, scientific, and technical achievements that exist in the West (I, of course, also have Japan in mind) will force our economic managers to ponder more often where and why we are inferior to them and to take steps on overcoming the lag. That is, glasnost can also fulfill here its cleansing, mobilizing functions.

[Question] Yevgeniy Maksimovich, please tell us briefly about the program of the club.

[Answer] We will try to take three groups of questions. First, the organization and management of production at the level of firms and enterprises. For example, such problems as the organization of multiple-shift work at enterprises, the assimilation of a new product and technology, specialization and cooperation, the forms of direct relations between firms, the mechanism of the interaction of private capitalist firms with the state and banks, the relations of producers and consumers, the quality and competitive ability of products, and so on. The telling about these aspects of foreign economics seems especially urgent for the restructuring of our economic mechanism, the increase of the independence of enterprises, and the development of cost accounting relations.

Another group of questions involves production efficiency and specific directions of scientific and technical progress in various sectors of the economy. Here we will not confine ourselves to the analysis of the present situation, but will also begin to publish forecasting materials and the corresponding foreign estimates for the future. They will also be of interest for current affairs.

Finally, the publication of articles of a general economic nature also seems necessary. On the one hand, the explanation to readers of the basic economic categories, but in close connection with the problems, with which our national economy is faced, should become their goal.

[Question] Could you illustrate the last thought with examples?

[Answer] By all means. Everyone, for example, often hears such terms as the gross domestic product, the national income, and so on. But what are these, from what are the indicators, which measure the level of economic development, formed? Is it not really interesting to examine this? I believe that, let us assume, the fact that in developed capitalist countries what is called the "nonproduction" sphere provides more than half of the gross domestic product, may be a revelation for many people.

Or such a question as the quality of economic growth. Western economists quite correctly believe that under the conditions of rapid structural changes and the acceleration of scientific and technical progress it is impossible on the basis of traditional quantitative indicators to judge the real changes in the economy. It is necessary to see precisely what processes lie behind some growth rates or others. That is, conditionally speaking, if in a country the growth rates are low or are even zero, but here the decrease of obsolete, inefficient, and energy-consuming works is occurring, while firms are actively seeking and assimilating new promising spheres of the application of capital, this is good. On the contrary, high rates with the retention of an inefficient structure of the economy, which does not satisfy the requirements of scientific and technical progress, can lead only to the increase of crisis processes.

Is this question really not important for us? For many economic managers continue to regard acceleration only as the increase of purely quantitative indicators, without taking into account the qualitative aspect. Although it is well known that it is better to make 1 good thing, which satisfies the consumer, than 10 which no one needs.

But take such questions as the correlation of state tax policy with the stimulation of individual initiative and enterprise or the placement of state orders when creating the conditions of interest in obtaining them or the implementation of the practice of contract prices along with the development of economic mechanisms which limit their inflationary growth.

[Question] Among the questions, which you named, there are, however strange it is, no comparisons and a comparative analysis of our and the foreign economy. Do you really not deal with this?

[Answer] You have touched on one of our most sore problems. Of course, we are attempting to deal with it. But I should state frankly that, alas, we are simply incapable of doing much here. And the main reason, the main trouble is Soviet economic statistics, which are extremely inadequate, and often incomparable with international economic statistics.

In the West everyone already understood long ago that to engage in economic activity without well-organized statistical information, which is accessible to the community at large, is just the same as to put out into the open sea without a compass. In a modern economy without comprehensive, detailed information it is simply impossible to diagnose economic problems in good time and accurately, to evaluate the advantages and efficiency of various works and the competitive ability of a product, to determine correctly the prospects of economic, scientific, and technical progress, and to make the optimum economic decisions.

I, frankly speaking, often think that for some of our economic managers the lack or departmental secrecy of statistics is a benefit, inasmuch as it makes it possible to conceal incompetence and the results of unskillful activity and to avoid glasnost, the monitoring and critical analysis of their work by outside organizations, and undesirable comparisons with world standards.

We hope that the steps recently taken in our country on the improvement of statistical work will change the situation radically. We will try as opportunities arise to acquaint readers with the results of comparisons.

[Question] And a last question. In what forms will the work of the "Business Club" take place?

[Answer] The word "club" in itself presumes several participants in the discussion. But I believe that within the space in a newspaper column, which has been allotted for the rubric, it is difficult to organize a substantive discussion. Therefore, let us begin with the publication of short articles of our specialists. It is also possible to hold "round tables" or "club meetings" on major themes, for example, such ones as the problems of resource conservation. Of course, more space will be required for them. In general, in my opinion, the forms of presentation of our materials should be flexible and interesting to the readers.

And we expect very much that an open dialog will spring up between us and the readers of *Sotsialisticheskaya Industriya* and are looking forward to letters, questions, and wishes.

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First CEMA International Seminar on Scientific Cooperation

18140058a Moscow EKONOMICHESKAYA GAZETA in Russian No 41, Oct 87 p 19

[Article by A. Solovyev: "Scientific Potential in CEMA Member Countries"]

[Text] The first international seminar of CEMA member-countries, held 7-11 September in Tallinn, was devoted to questions of development of cooperation of socialist countries in the sphere of science. It was organized by the USSR State Committee for Science and Technology, the CEMA Secretariat and the presidium of the Estonian SSR Academy of Sciences. The participants of the seminar—scientists-specialists in science [uchenyye-naukovedy], personnel of central economic organs, heads of institutes and associations of our country participating in carrying out the Comprehensive Program of Scientific and Technical Progress of CEMA Member Countries as well as specialists in science from Bulgaria, Hungary, Vietnam, the GDR, Mongolia, Poland and Czechoslovakia —exchanged experience in comprehensive analysis and assessment of the work of scientific and technical organizations.

In development of scientific and technical cooperation, an important role belongs to evaluation of the scientific and technical potential of CEMA member countries and evaluation of the results of scientific-research and experimental design work. Such an assessment makes it possible to select more substantively specific forms and methods of conducting joint research and to organize quickly on a large scale the introduction of scientific and technical achievements in all CEMA countries. At the same time, in the opinion of Doctor of Technical Sciences **V. Leontyev,**chief of the department of scientific and technical cooperation of the CEMA Secretariat, it is essential to create individual methodological principles of analysis and evaluation of the results of development of science and technology in CEMA member countries.

Yu. Pugachev, deputy chairman of the USSR State Committee for Inventions and Discoveries, stressed that in the period of restructuring of the national economy on the track of intensive social and economic development and transfer of scientific organizations to full cost accounting and self-financing it is important to aim analysis and assessment of work in the sphere of science at a sharp rise in payback from the use of all types of resources allocated for research and development and for cutting down on time and expanding the scale of introduction of basically new equipment based on inventions.

Intensification of social and economic processes on the basis of acceleration of scientific and technical progress is reflected in the structure of the entire national-economic complex. Today it is giving rise to a special sphere of economic activity—the production of intellectual products. **V. Makarov,** the director of the Central Economic Mathematics Institute of the USSR Academy of Sciences, believes that the period of emergence in leading scientific and technical positions of the world depends on how quickly and comprehensively the economy is restructured from development and production of mass products to development of unique intellectual products.

Yhr principles of radically improving the interaction and development of new forms of integration of science with production were examined in a report by Doctor of Economic Sciences **V. Groshev,** rector of the Moscow Institute of National Economy imeni G.V. Plekhanov, who noted that the revolutionary restructuring of the economic mechanism in the country and improvement of planning, price formation and the rest are not an end in itself but only the means to the quickest possible overcoming of technical backwardness and emergence in top world positions. The new forms of integration of scientific and technical work call for a new organizational structure and other methods of resource provision in science.

The report of Professor of the Academy of National Economy attached to the USSR Council of Ministers **Yu. Yakovets** dealt with validation of a system of criteria and

indicators of evaluation of scientific and technical products under the new conditions of management. He stressed that the new economic mechanism would oblige enterprises to reject obsolete equipment. At the same time, it is important to provide integrated planning of development and introduction of fundamentally new equipment at the state level through centralized sources.

A paramount role in assessment of the work of scientific-research institutes and design bureaus is played by the indicator of economic effectiveness of completed research and development. However, the methods of its calculation are imperfect and their content is frequently of an uncertain character. Major difficulties arise in the process of evaluating the work of international scientific collectives. For this reason many of the seminar's participants offered proposals on concretizing the economic content of this indicator in the evaluation of work of scientific-research institutes and design bureaus.

Foreign specialists shared their experience in organizing carrying out of analysis and assessment of scientific institutions in Bulgaria, Hungary, GDR, Vietnam and Poland. Thus, **Ja. Balcar** (Czechoslovakia) believes that the work efficiency of a scientific-research institute must be determined, on the one hand, by the substantiveness of concrete results obtained from completed work and, on the other, by the economic effectiveness of utilization of all resources of the institute.

Professors **Ye. Oleynikov** and **O. Volkov** and Doctor of Economic Sciences **P. Zavlin** stressed the special features of conducting a comprehensive analysis at scientific institutions relating to the development of various sectors of science—VUZ, sectoral and plant.

A keen discussion ensued on the question of the need of retaining the procedure of assessing the work of scientific and technical organizations on their transition to full cost accounting and self-financing. Speakers pointed out that analysis of scientific work formerly served only as an instrument for validation of the results of departmental and extradepartmental checks of scientific-research institutes and design bureas. Now in the new economic mechanism it is shifting in the opinion of a number of specialists into a channel of economic relationships between the customer and the developer and is becoming an inseparable part of them.

Another group of specialists believes that such analytical work in the sphere of scientific-research and experimental design work is intended to serve only as a method of cognizing a scientific collective's own possibilities, to provide information for self-assessment and to help reveal reserves. Thus **A. Csepregyi,** chief of the department of administration of researxh and development of the HPR State Committee for Technical Development thinks that it would be inadvisable to compare different-type scientific and technical organizations and different sectors with each other. In his opinion, scientific institutions of different countries are even less comparable.

The seminar's recommendations stress the importance and topicality of creating a single scientific recommending apparatus, a standardized terminology for carrying out comprehensive analysis of the scientific and technical potential of CEMA member countries and a regular and candid exchange of experience of economic assessment of the results of the work of scientific institutions of different countries. This will serve as an additional impetus for improving the use of existing scientific and technical achievements, strengthening forms of multilateral cooperation and enhancing the quality and level of joint research and development.

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Hungarian Discusses CEMA International Cooperation in Production

Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV in Russian No 6, Jun 87 pp 73-78

[Article by Eva Blanar, sector chief of the Institute of Economics of Industry of the HPR Ministry of Industry: "Direct Contacts: Prospects of Development—A Qualitative New Step in Mutual Cooperation"]

[Text] Despite certain successes in international specialization and cooperation of production (ISCP), CEMA member countries cannot be satisfied with the level reached in division of labor. Direct contacts of economic organizations are bound to play a major role in the development of this process.

At the same time, it is necessary to create conditions from the very start so that this form will truly signify a qualitative new step in mutual cooperation of our countries. First of all let us agree on the fact that at the time when general questions, including spheres, size and purposes of cooperation, are being decided on in the course of coordination of plans on the interstate level, its concrete coordination is carried on between cooperating enterprises. Otherwise, if the macrolevel of administration reserves major rights with respect to the concrete conditions of cooperation, the process of coordination will only be strained. And this in turn could result not only in a drop of the prestige of direct contacts but also in an increase of general and specific expenditures in reciprocal foreign trade.

Contribution to Cooperation

And now let us speak in detail about how direct contacts are already being manifested in international division of labor. For example, they create the best of conditions for the development of production cooperation, first of all there where cooperation has long been established and the partners are conducting a reciprocal exchange of components and parts. It is necessary to keep in mind that at the present stage of scientific and technical progress these become obsolete rather quickly. That is why timely, effective coordination of regularly arising, as

a rule, extremely insignificant changes pertaining to the technical parameters of general production is important. However, these changes ensure competitive products and consequently affect the personal interest of enterprises participating in mutually beneficial exchange of components and parts.

Undoubtedly, specialization no less than despecialization in the production of one item or another results in certain structural changes in the national economy. Consequently, a decision on expanding or conversely on terminating production is adopted in socialist countries as a rule by competent state organs. They pronounce judgment on a number of other major problems (for example, the reliability of specializing partners, price and delivery schedules). At the same time, useful information on these questions accumulates at interested enterprises taking part in production cooperation.

At the same time, I believe that it is impossible to exaggerate the role of contacts among economic organizations. The purpose of these contacts is not at all for them to lead to major structural changes but to fully promote a more effective solution of problems assigned to the immediate performers. State administration organs will have to organize these tasks as before. I assume that in the foreseeable future direct ties will not be able to perform all the functions connected with mutual cooperation and will be unable to replace important interstate agreements. Such questions as, for example, expansion of reciprocal trade, capable of bringing about a significant increase in production and in this way power consumption or growth of imports from capitalist states, must be the exclusive prerogative of state administration organs.

Another thing is the derivation of additional benefits and a more comprehensive and complete study of problems at the enterprise level. All this will lend greater flexibility to our cooperation, will provide for the preparation of individual joint measures and will increase the personal interest of interacting economic units.

It would be advantageous for direct ties to be applied to the coordination of plans of scientific and technical development of enterprises and on the basis of such coordination for direct producers to participate in the joint development of individual problems, for example, in prediction of prices of produced products while taking into account the specific technico-economic parameters of products of the same type produced in the West. These conclusions would helpful for use in future work and for the study of possibilities of greater specialization. At the same time, it would not at all be obligatory for the parties to search within the framework of each agreement between enterprises ways of cooperating unconditionally throughout the entire cycle of science—equipment—production—sale. Most important of all is to be oriented toward spheres of activity of mutual interest, and these (especially at the very beginning of contacts) could be quite narrow.

It would also appear that we should not try at the outset to decisively solve all the problems of direct contacts. I cannot agree with those who believe that direct ties apparently have to be necessarily transformed into joint economic activity and that joint enterprises would arise at any rate on their basis.

In general, the supposition that the actual forms of international economic cooperation can solve its problems that have long come to a head is quite erroneous. Such a simplified view only diverts attention from the real problems that hold back effective cooperation. At the same time, a manifest tendency is to be observed of late in the economic literature to describe anticipated or desired results, which in the opinion of the authors arise in the course of certain organizational measures in foreign economic activity. Is this not why the creation of joint enterprises is frequently described as an end in itself, as a panacea, capable of instantly putting an end to all the difficulties arising in the way of cooperation? At the same time, a great deal that is disputable exists in questions on forms of development of direct ties and on responsibility for possible losses in the operation of an international economic unit. For example, in my view, joint stock companies or companies with limited responsibility should be considered a more acceptable form at this stage of cooperation.

It is also necessary to say that artificial dissemination of new forms does not simplify but, on the contrary, complicates development of integration inasmuch as it results in an expansion of the number of "risk zones" in foreign economic activity. I do not reject the actual idea of creation of joint enterprises, but I am for a carefully thought out and balanced search for reliable methods of solving existing problems of cooperation and against copying forms and methods tested in quite different capitalist conditions of management.

Typical Classification

In what fields should direct contacts be used for the solution of what kinds of problems? I wish to present my own ideas in this regard without laying claim to a full and all-embracing grasp of the problem. From the point of view of the **subjects of cooperation**, direct contacts can be broken down into the two following groups:

First. Interaction of economic units of the same type (industrial enterprises and associations, scientific-research institutes and design bureaus), which is conducted on the basis of specialization, exchange of experience, mutual working out of individual problems of interest to both sides. Contacts among the subjects of cooperation of the same type presuppose as a rule specialization and cooperation on an international scale.

Second. International economic relations between different-type economic organizations. The present stage of development and cooperation of our countries, realization of the Comprehensive Program of Scientific and

Technical Progress requires the expansion of mutual contacts between organizations of the scientific-technical and production sphere. There should be included in this group direct contacts of economic organizations cooperating at different stages of the cycle science—technology—production—sale, particularly in the areas of standardization and unification, verification of the quality of mutually supplied products and the like.

And now let us try to examine direct contacts from the point of view of **objects of cooperation.** In most instances, these contacts are carried out on the basis of concretization of agreements achieved on the interstate level in coordination of commodity flows, since the structure of commodity turnover does not come under the competence of the cooperating producers. For example, state organs agree among themselves on increasing deliveries of machine tools, but it is better for machine-tool building enterprises to determine their specific products list. Or let us take another case: while general contingents of consumer goods are considered by countries at a macrolevel, which ones, for example, tape recorders, bicycles or fabrics designated for reciprocal exchange, can be effectively decided on in the course of direct contacts.

It is also perfectly clear that the system of contingents of mutual trade is not in a position to encompass all the known areas of cooperation, especially to ensure the sale of above-plan production. This also applies to the reciprocal supply of small lots of needed parts. It would be practicable to solve these and like questions through direct contacts. At the same time, the general conditions of such deliveries should be as before carried out by competent administrative organs of the cooperating countries.

Let us examine in greater detail the possibilities of sale of above-plan production on the CEMA market. Let us imagine that an enterprise of some country has formed a commodity fund as the result of above-plan production (or refusal of deliveries by a foreign or domestic buyer) or that free production capacities exist. A natural desire arises in this enterprise, without turning to superior administrative organs, to quickly and independently or through a foreign-trade firm to sell the products to economic organizations of other CEMA member countries. Undoubtedly, the requisite information on buyers will be required. Probably, they will first of all have to be those economic organizations which maintain direct ties with this enterprise.

And so a deal was completed. The sale was made for national currency and for domestic prices of the buyer country. What must be done for the seller enterprise to be able to make use of the obtained proceeds? First of all to open an account in a bank of the buyer country in its national currency. However, it could happen that the seller might not want to acquire goods in this country and for this currency. Then still one more operation would be required. Let the owner of the acquired funds turn them over in his country to another economic organization wishing either to buy goods in this currency or to use it for covering the costs of assigned work of specialists. As far as is known, such an operation would not be of much trouble for national subjects.

Other ways of using acquired funds also exist, for example, with the aid of intermediary economic organizations wishing to purchase goods or needed services in another CEMA member country. In such a case, the middleman (especially in Hungary, his functions could be performed by the Chamber of Commerce) can rather easily find in his country potential exporters of products to these or other partners.

At the same time, it is necessary to point out that the proposed procedure could be used best of all in the production sphere, first of all then when purchasers have an above-plan demand. It also opens up favorable prospects for the export of consumer goods. In such a case, it would be useful for direct buyers and sellers to serve as the department stores of our countries.

Of course, one cannot be absolutely sure that in the functioning of such a system a number of large "submerged" rocks will not appear. But its undoubted advantages pertain to the development of not only "small-scale" exports but also nontraditional contacts between economic organizations of CEMA member countries, for example, in such an important field as mutual utilization of the scientific and technical potential of partners participating in the development of targets of the Comprehensive Program of Scientific and Technical Progress. It could be a question of effective ordering of planning and design developments, creation of new models of equipment and their testing for quality and correspondence to the level of world-class examples. At the present time, an excessively unwieldy and complex procedure exists for making out orders for such types of services.

Impetus for Initiative

We have already spoken of the importance of international cooperation among economic organizations of the same type. However, the need frequently arises for establishing contacts of a so-called intersectoral character particularly in areas which from the point of view of operation of the national economy do not present any major interest. At the same time, here are to be found large reserves for the development of direct contacts. By way of illustration, let us turn to such a rather narrow problem as wide-scale dissemination of models of women's and children's clothing. Patterns made in some countries could be successfully used in others not just in the interest of light industry but also of the vast number of women who can and love to sew themselves. In such a case, let us say a sewing factory in the GDR could sell patterns to the editors of a style magazine in Hungary. Such a variant is also possible where several economic

units from the seller country take part. In such a case, in addition to a pattern, a customer is also offered fabric and accessories (buttons, zippers and so forth).

Let us now turn to material and technical supply. As is known from practice, stores of production enterprises frequently accumulate stocks of all kinds of materials. But these stocks are meaningful only to the given enterprise. For the sector as a whole, not to speak of the country, they are insignificant. It would make no sense to include them in an export program. How then can this "dead weight" be used effectively? The idea is to conduct unique international fairs where representatives of industrial and foreign-trade organizations could meet. In all probability, there will be found among the enterprises of different countries many seekers wishing to acquire this or that material lying stored in a neighboring country.

Such fairs with the participationm of the immediate producers could be advantageously conducted for the purpose of using temporarily free capacities (in the form of customer-supplied raw materials).

In all cases payment could be made in national currency at prices set on the basis of a mutual agrement and the receipts to be used according to the designated system.

Contacts in the Field of Science and Technology

The development of cooperation in CEMA at all stages of the cycle science—technology—production—sale and the shifting of its center from the interstate level to direct contacts require the creation of favorable conditions for linking up the scientific and technical potentials of our countries. Let us examine one of the most important aspects of this problem, namely the establishment of direct contacts for the purpose of developing scientific-technical and scientific-production cooperation with the aid of international trade organizations.

But why specifically trade organizations? Is not such a form used in reciprocal trade?

The fact is that in mutual trade, as in the joint investment activity of our countries, time-tested and verified-in-practice ways of looking for the best partners have long been in operation. As for scientific and technical cooperation, no experience of establishing contacts actually exists in this field.

At the present time, scientific-research institutes of different countries maintain practically only "horizontal" contacts. The institutes cooperate as a rule by specializing in the study of various fundamental problems or in research of an applied character. But life demandingly calls for the development of relationships among themselves and with production associations. Only on the basis of such integration would it possible to find a way where the latest scientific and technical developments do not gather dust on the shelves of ministry offices but are introduced into practice without delay.

Let us say that some ministry of one of our countries has at its disposal a technical innovation produced as the result of research in a jurisdictional laboratory. Not being able to independently introduce the innovation, the ministry notifies international trade organizations with appropriate payment. Testing-design and experimental enterprises or firms that would be disturbed over the introduction of this innovation participate in them. Such trade organizations may also inform an industrial enterprise interested in performing a certain task, for example, remodeling or modernizing a shop or reducing production materials and power intensiveness.

Trade organizations could serve as a place for meeting future partners in cooperation and could promote the development of direct contacts of scientific, engineering and industrial organizations. Finally, they could facilitate the solution of the problem of internal disproportions in the scientific and technical sphere. This is due to the fact that the structure of the scientific-technical and planning-design potential in not a single one of our countries does not coincide in practice with the structure of needs for the results of scientific-technical and testing design developments. Thus in international cooperation, temporary or permanent differences in the possibilities and needs in this sphere are corrected.

It is perfectly clear that the organizational and legal prerequisites for the development of direct contacts examined in the article are inadequate for their broad and effective employment in economic and scientific and technical cooperation of CEMA member countries. For the further development of such contacts, economic conditions and the creation of an effectively flexible mechanism of interaction are important. While attaching major importance to direct contacts of economic organizations, it is necessary to emphasize once again that changes in the level of coordination of concrete questions of cooperation do not mean in themselves the solution of all problems of socialist economic integration. And direct contacts, as was pointed out, can significantly boost the effectiveness of cooperation, better disclose existing reserves and speed up implementation of various joint measures. But if the chief hindrances in the way of development of the integration process (for example, the bilateral character of trade and the necessity of bilateral balances) remain unchanged then the development of direct contacts can only result in the arising of additional difficulties both wihin national economies and on an international scale. And for this reason, the overcoming of these hindrances and improvement of the general mechanism of cooperation must become one of the chief tasks of CEMA member countries at the present stage.

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Management of Priority Directions of CEMA Comprehensive Program

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[Article under the rubric "The Comprehensive Program of Scientific and Technical Progress: The Strategy of Acceleration": "The Priority Directions of International Cooperation and the Mechanism of Management"]

[Text] The Comprehensive Program of Scientific and Technical Progress of the CEMA Member Countries to 2000 (KP NTP) gave a powerful boost to the interaction of the fraternal states and to the development of intensive forms of international cooperation and specified the new tasks of all the participants in cooperation.

The nearly 2 years of implementation of the Comprehensive Program of Scientific and Technical Progress testify to the large-scale dynamic progress of joint research, which is called upon to give acceleration to the socioeconomic development of our countries.

The first meetings of the supervisors of the priority directions of the Comprehensive Program of Scientific and Technical Progress—electronization, integrated automation, atomic energy, new materials, and biotechnology—played an important coordinating role here. The participants in the meetings—prominent statesmen of the CEMA member countries, well-known scientists—not only examined the first joint results and agreed on the necessary steps on their production assimilation, but also discussed the economic conditions of interaction. Specific shortcomings in its organization were identified.

Indeed, it was not possible to complete everything that followed from the decisions of the CEMA Session (the 41st [extraordinary] meeting) for the past period. For example, the international documents, which were intended for signing already last year, saw the light with a delay. A similar lag was also observed during the 1st quarter of 1987.

It was also established that far from all the assignments on the output of new products, which are being developed in conformity with the Comprehensive Program of Scientific and Technical Progress, ensure the achievement of the predicted world level, while more than 20 percent of them will conclude only with the stage of scientific research and experimental design development (NIOKR) and, thus, will not be assimilated in production.

All this is creating the need for the improvement of the methods of cooperation in CEMA. And although the mechanism of the management of the Comprehensive Program of Scientific and Technical Progress at the international level for the most part has not undergo substantial changes and has been preserved in the form in which it was adopted at the 41st (Extraordinary) CEMA Session, it is proposed to make a number of refinements in it.

First of all it is envisaged to strengthen the leading role of the main organizations for problems of the Comprehensive Program of Scientific and Technical Progress, which conduct direct relations on a contractual bases with coperforming organizations from the CEMA member countries. This is the basic unit of the organization and coordination of scientific and production interaction. Jointly with the coperformers the main organization is responsible for the technical level and quality of the product being designed and for the extensive use of the results of cooperation in production.

For this purpose it has been granted many rights. For example, to conclude on its own behalf contracts for scientific research and experimental design development, the production of prototypes of the product, and the mutual transfer of results and test batches of items. Other organizations and enterprises, which are participating in the implementation of the Comprehensive Program of Scientific and Technical Progress, are receiving similar rights.

At the same time the noted organizational shortcomings of cooperation were the result of uncoordinated actions first of all at the level of economic organizations and enterprises. In what is the oversight seen here? The main organizations were not capable of fully engaging the available economic levers. Is that not why with respect to the majority of problems of the Comprehensive Program of Scientific and Technical Progress there is no technical and economic substantiation of the advisability of performing work, while in the detailed programs, which were also formulated under the supervision of the main organizations, the end results are not always clearly distinguished? The technical level of the product being developed as compared with the best foreign analogs is not analyzed thoroughly enough, there is no estimate of the cost of joint work, as well as the expenditures of individual countries on the output of finished items.

Clearly, without having a full idea of the results, it is difficult to find both a client and a producer of the product. For often only when concluding contracts did some performers find out the details of the tasks being set for them.

This was one of the reasons that in the majority of cases the partners were not able to determine even the approximate needs for the product being developed, and especially to plan the capacities for its production.

As a result the joint accomplishment of the assignments of the Comprehensive Program of Scientific and Technical Progress is developing slowly on a contractual

basis. The process of preparing contracts on the international specialization and cooperation of production (MSKP) for 1987 is also being dragged out.

Thus, the principle of the full cycle—from the idea to the production and marketing of the finished product—which has been made the basis of the fulfillment of all the assignments of the Comprehensive Program of Scientific and Technical Progress, is being violated. And in this sense as a organizing document the detailed program has not completely justified itself.

That is why the proposal on the drafting and coordination of detailed plans of the stage-by-stage development and industrial assimilation of all types of products with respect to each of the problems of the Comprehensive Program of Scientific and Technical Progress was advanced at the 42d meeting of the CEMA Session (1986). Many CEMA member countries supported this proposal. The main organizations began the preparation of such plans.

It is proposed to clearly establish the ministries and departments, as well as performing organizations that are responsible for the fulfillment of the assignments of the Comprehensive Program of Scientific and Technical Progress from the fraternal countries. At the same time the total expenditures of each of them, including on scientific research work and capital investments, will be specified. The tentative needs and the approximate production volumes, the capacities being put into operation, and the basic technical and economic characteristics of the product being developed will be described in the plan. When evaluating its technical level a comparison is made with world analogs, moreover, not in general, but at the moment of introduction in production and in the future.

Such plans after approval in ministries and departments of the CEMA member countries could be approved by the supervisors of the priority directions of the Comprehensive Program of Scientific and Technical Progress, and subsequently be taken into account when coordinating the five-year national economic plans. It would be possible on their basis to conclude contracts on the international specialization and cooperation of production for the next five-year plan.

At the same time it seems advisable that the drafting of basic international plans, which are of great national economic importance and in accordance with which intergovernmental (interdepartmental) agreements will be signed, would be included in a special section of the Coordinated Plan of Multilateral Integration Measures.

As has already been noted, the scientific research and experimental design development of the main organizations and coperforming organizations has still not been completely developed on a contractual basis. Meanwhile this is a decisive direction in the implementation of the Comprehensive Program of Scientific and Technical Progress. For, when making arrangements on joint work, the partners—institutes and enterprises—assume quite specific obligations on the implementation of a unified technical policy.

Today cooperation in those areas, in which specific scientific results have already emerged and in which their quick practical application is possible, is assuming great importance. So why are the instances, when the organizations of CEMA member countries prefer to conduct such development on their own and to turn over only the end results in accordance with contracts, still so frequent? The whole point is the lack of contracts for joint work: only in them is it possible already at the very start of cooperation to fix the prices, to stipulate the sanctions for the failure to fulfill assumed obligations, and to specify the conditions of the use of the end results. There are no such contracts, and instances, when partners without sufficiently convincing grounds for this suggest overstated prices for the product being developed, which exceeds analogs by several fold, are arising.

How are such situations to be avoided in the future? The majority of organizations of the CEMA member countries correctly believe that when there is an intergovernmental (interdepartmental) agreement on cooperation, it is necessary to switch as quickly as possible to the conclusion of contracts at the economic level.

The imperfection of economic, legal, and financial regulations, as well as methods of planning within CEMA is hindering the further development of contractual relations.

The question of affording the main organizations opportunities to supervise the work on the entire science-technology-production-marketing cycle is also urgent. In particular, in order to actively participate in commercial activity, they should have financial assets for paying for the services of coperformers from the fraternal countries and stimulating them in the fulfillment of the assignments of the Comprehensive Program of Scientific and Technical Progress, as well as should purchase licenses and know-how by means of their own or borrowed assets. Finally, the main organizations are quite capable of working in close contact with clients, producers, and consumers of the finished product. For this purpose it is necessary to grant them the right to purchase production equipment, instruments, components, assemblies, blocks, and materials, which are intended for the accomplishment of the assignments of the Comprehensive Program of Scientific and Technical Progress.

At the same time the main organizations should exercise more extensively the already available rights. For example, being responsible for the high technical level of the product being developed, they are obliged to carry out the constant monitoring of its state—from the moment of the drafting of detailed plans and the conclusion of contracts to introduction in production. Here one must not limit oneself to analysis alone, it is necessary to

formulate and implement measures on the gradual achievement of the long-range world technical level. One should remember the technological possibilities of production and study the willingness of the consumer to use the product being developed. From the very start it is advisable to include in the cooperation the clients (industrial associations and enterprises), coordinating with them the conformity of developments to the best world models.

At the interdepartmental level the CEMA Committee for Cooperation in Scientific and Technical Research (KNTS) and the CEMA Committee for Cooperation in Machine Building, the CEMA permanent commissions for the radio and electronics engineering industry, for new materials and technologies of their production and processing, and for biotechnology, as well as the intergovernmental commissions for cooperation in computer technology and in atomic machine building supervise the cooperation in the priority directions. They are called upon to provide assistance to the main organizations in the fulfillment and coordination of the work in the corresponding directions and in the revision and supplementing of specific programs of interaction.

Other CEMA organs and international economic organizations (MEO's) are responsible for the course of cooperation on individual problems, participate in the drafting of multilateral agreements, and monitor their fulfillment. The overall coordination of the work on the Comprehensive Program of Scientific and Technical Progress has been assigned to the Committee for Cooperation in Scientific and Technical Research.

However, the facts testify that, despite the afforded opportunities, the CEMA organs, the intergovernmental commissions, and the international economic organizations frequently display passivity in the implementation of the Comprehensive Program of Scientific and Technical Progress and devote much attention to the consideration of special questions, without solving its problems as a whole. Their activity first of all should be aimed at the development of effective direct relations between the cooperating partners. These organizations should become centers of the discussion of all constructive proposals on the establishment of joint collectives, international laboratories, associations, and joint enterprises and organizations, as well as the problems, on which it is advisable to conduct cooperation on the basis of common assets. The financial, information, personnel, and license support of the Comprehensive Program of Scientific and Technical Progress should be in their field of view.

So far there is no precise distribution of duties among the CEMA organs, which are responsible for cooperation in some priority directions or others and for the corresponding problems of the Comprehensive Program of Scientific and Technical Progress.

At the same time it is necessary to increase the role of CEMA organs in the preparation and coordination of intergovernmental (interdepartmental) agreements and contracts on the international specialization and cooperation of production and in the development by joint efforts of capacities for the industrial assimilation of a new product.

At present a fundamental understanding on the organization of several international scientific and technical centers, particularly in the area of electronization and biotechnology, has been reached. The final decision on these questions will be made after the consideration of the corresponding technical and economic substantiations. The proposals on the terms of their activity should also be considered by CEMA organs.

The overall monitoring of the fulfillment of the Comprehensive Program of Scientific and Technical Progress at the intergovernmental level has been assigned to the CEMA Executive Committee, which at all meetings examines the progress of the accomplishment of its assignments. However, despite this, the problems of the interconnection of the tasks of the priority directions have not been solved. That is why it is thus far unclear whether, for example, the pace of development of the production of ultrapure materials conforms to the rapid development of electronization, while its pace conforms to that of integrated automation. Such "discrepancies" lead to the duplication of work in individual directions. Is that not why both specialists of integrated automation and associates of institutes, who are developing new materials, are fulfilling similar assignments, for example, in the area of welding, hard facing, and thermal cutting? There are instances of the formal inclusion in the Comprehensive Program of Scientific and Technical Progress of themes of cooperation from various prevailing agreements.

In order to obtain an economic impact as quickly as possible, it is necessary in each priority direction of the Comprehensive Program of Scientific and Technical Progress to single out the most important special-purpose scientific production and technological projects. The detailed plans, which have been formulated with respect to each of them, can serve as appendices to intergovernmental (interdepartmental) agreements.

The question of the organization of cooperation in a priority direction—the electronization of the national economy—within one CEMA organ was repeatedly discussed, but never found continuation.

Among the open problems of interaction is the use of joint developments. First of all this concerns new materials, programs, and the development of computer-aided design systems, in the coordination of which several countries have thus far not specified their participation and have not signed intergovernmental documents.

Let us also mention such a barrier, which is standing in the way of the intensification of socialist economic integration, as the differences in the prices for the same product, which is delivered by the same producer to different countries. At times they are unjustifiably set too high. It seems that the time has come to revise the procedure of forming the prices for the final product, to specify the procedure of the pricing of jointly developed items, and to simplify the mechanism of the transfer of hardware, particularly programs on magnetic media.

The need arose long ago to speed up the passage of documents, which are connected with the Comprehensive Program of Scientific and Technical Progress, and to form a flexible system of information that is capable of describing the progress of scientific research and experimental design development, as well as the joint efforts in production cooperation.

Among the most important problems of cooperation at the present stage are the systematic analysis and the improvement of the long-term goals of the Comprehensive Program of Scientific and Technical Progress. For this the drawing up of long-term forecasts should be carried out periodically within all five priority directions. They should become the basis of the formation of the strategy of the development of scientific and technical progress and cooperation of the CEMA member countries during the next millennium.

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